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THE NESTING HABITS OF *POLISTES RUBIGINOSIS*, WITH SPECIAL REFERENCE TO PLEOMETROSIS IN THIS AND OTHER SPECIES OF *POLISTES* WASPS

BY PHIL RAU

Kirkwood, Missouri

The ingenuity of various species of *Polistes* in their task of nest-building, and the consistency with which each species adapts the nest to the chosen situation, have ever been the cause of pleasant surprise to the student of these wasps. In a paper recently published¹ on the habitat of *Polistes*, we find that each of the four species that are common hereabouts choose nesting-sites which are more or less distinct. *Polistes pallipes* build their symmetrical nests in sheds, barns, and under the eaves of roofs where space is not limited. *Polistes variatus* make their nests more compact, to fit small spaces under rocks on the ground or in pockets in banks of soil. *P. annularis* build nests in the tree-tops, with a side-wise tilt and a heavy roof to shed the rain. But *P. rubiginosis* long kept their secret of where they hid their nests. It was indeed puzzling that the literature contained so little on the habits of a wasp which is so common and conspicuous in the fields. The reason is evident when we learn that they habitually build in dark, inaccessible places, often high up out of reach, in hollow trees, or

¹ Ecology, 10:191-200. 1929.

behind the walls of old wooden buildings where they find ingress and egress through a tiny crack or knot-hole (Figs. 1 and 5) some distance from the actual site of the nest.

Under these conditions, I was indeed fortunate in finding a nest of *rubiginosis* unusually low so I could make observations on their behavior. Since these wasps prefer dark, inaccessible places, the queen which began this one



FIG. 1.

found an ideal spot here. The little shanty was one of a half-dozen huts which had been built for the storing of ammunition during the war. They stood in a large woods about seven miles from the city, but now were unused and abandoned. This was a sheet-metal structure among half a dozen wooden ones in a row, all windowless and dark, with only a small opening near the top of each for ventilation. With the door closed, the place was dark enough

to make happy the heart of any seclusion-loving creature. Here it was that, on opening the door on October 13, 1928, I was delighted to find a colony of these wasps. The nest was large, with all of the cells empty, and occupied by about fifty fine adults, which I supposed were queens. This was my opportunity to learn something of their habits of hibernation, and the founding of new colonies the next spring. I have already shown² that in *P. annularis* the queens hibernate some distance away from the nest, but on warm, sunny days of winter they often return to the old homestead, and when they make ready to found their own colonies, they do so in the vicinity of their former home, often with several queens co-operating in constructing one nest, and occasionally biting out the cell walls of their old nest for building materials for the new.

These, then, were the problems which I wished to solve for *rubiginosis*:

(a) Will these queens hibernate on the nest all winter, or will they disseminate?

(b) Will they revisit the old home during the warm days of winter?

(c) When they do build in the spring, will they choose nesting-sites near to the one where they were born?

Occasional visits to the shed yielded the following data in answer to the above questions:

On October 13, fifty queens were on the nest; on October 27, forty were there; on November 4, ten remained, and on December 3, three were on the wall near the site, the nest having fallen to the floor. A careful search through the five similar buildings nearby revealed none on these dates. This shows that they do not hibernate on the nest, but wander elsewhere; that they do not leave the nest in a body or swarm, and that some cling to the nest more tenaciously, literally and figuratively speaking, than do others. But the fact that they do not leave in a body does not mean that they do not hibernate gregariously, for

² *Annals Ent. Soc. Amer.* 23: 461-466, 1930.

during the previous year in January, I discovered about a hundred queens of this species huddled together in the galleries of the carpenter ant in a fallen tree. They were grouped in three masses, and when taken into the laboratory would often come out of the log when the room was warm, but would always huddle together in the galleries when the room became cold.

I cannot say with certainty whether they return on warm days to the old home, thereby refreshing their memories of the site. I was unable to visit the place during the winter as often as I intended: however, on three visits on very warm days in February no wasps were present.

Fortunately, we have a more positive reply to the question whether the queens build their new nests near the place where they were born, after having spent the winter elsewhere in hibernation. Likewise the question, does more than one queen work together on a nest, is answered in the affirmative, as the following data will show regarding these two points.

My next visit to the row of sheds was on June 8. There I found in the little house a new nest, just a few feet from the site of the old one. As mentioned before, the old one had fallen during the early winter, and I had left it on the floor, but it had been carried away during the winter. Hence the nest itself could hardly have been the object which they remembered or which attracted them, but the little building itself. This new nest was hexagonal, with 148 cells, only 8 of which were capped; the rest were shallow and filled with eggs and larvæ of various sizes. There were no full-sized empty cells from which adults could have emerged; in spite of this, however, seventeen adults were on the nest. These, then, were undoubtedly the queens which had emerged the previous autumn. Of course, when one finds more than one queen on the nest, one suspects that the surplus queens sink into the insignificant role of workers, while only one rules the nest in royal fashion. Whether or not this happens has yet to be ascertained, but here with so large a nest so early in the year, it is quite probable that all the queens had shared

in the labor of its construction. Not all of the queens were on the nest when I arrived at 9 a.m.; only eleven were there, but during the following three hours, six came in, some carrying materials and others left from time to time. Since all of these queens were given individual marks, I could make certain that the majority of them shared in the work.

The adjacent building, made of wood, similar in structure, equally dark and only two feet away, had contained no nest the previous year; now it harbored three nests of *rubiginosis*. One of these had four queens and 48 cells, another had two queens and 35 cells, and the third had one queen and 15 cells. The number of cells was only roughly in proportion to the number of queens per nest; the more queens, the more cells per nest. This, in turn, would mean, as one would expect, that all or most of the queens do work. However, it is evident that as the number of queens on the nest increases the work done by each individual is proportionally less. The nest with seventeen queens averaged nine cells per queen; the one with four queens averaged twelve cells each; the one with two queens averaged seventeen cells, while the lone queen had made fifteen cells. An individual *rubiginosis* mother, even though of larger size than *pallipes*, builds no faster than many queens of the latter; this is shown by a comparison of the size of the nest of this species with that of *pallipes*. Six nests of the latter in nearby buildings with one mother each, had 15, 20, 14, 12, 10 and 7 cells on this same date.

To summarize, then, we find that, like *P. annularis* of the tree-tops, this species remembered the old nesting-site and returned to it after hibernating elsewhere, and disseminated from the place of their birth, but did not go very far from it to build their own nests.³ One or more queens founded the new nest and shared in the work. The founders

³Hoffer (Clements and Long, Experimental Pollination, p. 248. 1923) found that bumble bees remembered the place of their nest from the middle of October to April, when they returned. Also see article by Frison, *Canad. Entom.* 62: 51, 1930, who also finds that bumble bees remember the home site after spending the winter in hibernation.

of the nest were true sister queens, sharing in the activities alike, and so far as I could see no individual assumed the haughty role of queen.

At this point it will be well to digress from the nest-building habits of this species and discuss the facts of pleometrosis and its origin.

In a very interesting paper by Dr. J. Bequaert, entitled "Vestigial Pleometrosis in the North American *Polistes pallipes*,"⁴ the term "pleometrosis" (which Wasmann introduced for ants) is used to signify the founding of a new colony by two or more fecundated females. Bequaert says that when pleometrosis occurs "among strictly monogynous wasps as with *Polistes*, it is well worthy of careful investigation, since it evidently is then one of those vestigial instincts whose study is of great value for a proper understanding of animal behavior."

Pleometrosis occurs here about St. Louis abundantly in *P. annularis*, occasionally in *P. rubiginosis* and but rarely in *P. pallipes*. This seems to be contrary to the findings for *P. pallipes* about New York.⁵

After viewing the occurrence of this habit in our *Polistes*, I am inclined to believe that pleometrosis in our northern species of *Polistes* had its origin in the "swarming" habit of tropical *Polistes*. In a paper now in course of publication on *Polistes canadensis* and *Polistes versicolor* of Barro Colorado Island in Panama, I show that when the colony grows too large or a catastrophe occurs to the nests,

⁴ Bull. Brooklyn Entom. Soc. 18: 73-79, 1923.

⁵ During a period of ten years, I have seen, among a thousand or more nests of *P. pallipes* examined, only six nests with two queens, and only one nest with three queens. I have always been on the lookout for the nests in the spring before the workers emerged, so that I could mark the queens with paint and find if one was truly a specialized egg-laying queen, and the other sank into the insignificant role of worker. In every case where this was tried, the queens deserted the nests soon after the ordeal of being marked, and the problem remains unsolved. Had I waited until larvæ were in the cells they might have been more faithful to their tasks; one must, however, mark the queens in *pallipes* before the young emerge, since it is not possible to distinguish workers from queens by either size or color. In course of two years I have been able to examine only about twenty-five nests of *P. variatus* in early spring, but I have never found more than one queen founding a nest.

swarming occurs much after the fashion of swarming of honey bees, with this difference; whereas the honey bee swarm seeks a new location in body, the swarm of *Polistes* wasps in the tropics breaks up into many smaller groups of few or many individuals, and these found the new homes. In the tropics where winter and hibernation do not occur, this is the method of dissemination. In the north, cold and hibernation interfere with this method, but we do see an adherence more or less complete (but in certain species no less complete) to the habit of pleometrosis, after assembling on the old home site which, after all, is very similar to swarming. This may or may not be vestigial in character, for it is difficult to tell whether pleometrosis is ascending to higher socialization, or is in a vestigial condition.

Thus we see that the occasional condition (more or less frequent according to the different species of *Polistes*) of more than one mother founding a colony has an analogous counterpart in the swarming of a sister species in the tropics. There seems to be but little difference between the psychological reactions of members of a colony when activities are cut short by the violent destruction of the nest in the tropics, or the violent curtailment of their activities in the north by the cold. In both cases, members of the colony disband and found new colonies with one, two or more queens present; however, in the tropics the founding of new colonies occurs immediately after adverse conditions occur, while in the north the founding of new colonies is interrupted by a period of hibernation in which the wasps are numb with cold. In any event, the long period of dormancy in the northern species apparently has not caused the wasps to forget how to behave like their tropical sisters when colonization occurs. Pleometrosis of *Polistes* in the tropics is due to the fact that with a twelve-month calendar, the colony splits up occasionally when it reaches great size, and one to many sister wasps go forth and found a new nest. But in the north where cold weather curtails the *Polistes* activities to only a fraction of a calendar year, pleometrosis undoubtedly has its origin in the queen's remembering the home

location, going there in the spring and meeting sister queens, and founding their nests near by. This marked difference between the two populations exists, however: in the northern *Polistes*, only the queens survive the winter and are ready to scatter in the spring, whereas in the tropical species, some of those which found new colonies may be workers. Bequaert (*loc. cit.* p. 76) says that in some species of tropical *Polistes*, "it is often hardly possible to distinguish externally workers from fertile females, and in some of the species it is even doubtful whether a differentiated worker caste is present."

Of course, if all of the wasps built close to the old home, there would be no world-wide distribution. Some of them fare forth alone to greater distances. Even so small a trait as this shows that they have individual psychological characteristics upon which selection may play. The inclination to stay near the old home or the inclination to venture farther may be very significant in the development of the habits of the species. It is the difference between conservatism and initiative, which, small in the beginning, may be vast in the end.

In this instance of fifty *P. rubiginosis* that were seen on the nest October 13, only twenty-four appeared the next spring, building the four nests already referred to. Some of the other 26 must have gone to greater distances to build, unless the mortality was that great. The powder-houses in which these nests were found had presented the same opportunities for this species to build for the past five years, but this is the first time that one of these pioneers found it good for a nest, and fixed a site for twenty-four of her less venturesome descendants. Of course, in studies of this kind we can follow only the lives of those conservative individuals which remain near home; of those venturesome pioneers which blaze new trails, we can have nothing to say. The first *rubiginosis* queen that came to this shed must have ventured some distance from her old home, perhaps in some hollow tree.

With these four new nests of *rubiginosis* at hand, all within easy reach of the eye (an unusual condition), I made plans for learning more of their habits, but unfortunately

the house containing the three nests was destroyed by the new owner of the grounds, and an accident befell the fourth which was in the metal house. The latter, however, gave me the following notes before the occurrence of the accident.

This nest with seventeen queens was revisited on June 19, after a nine-day absence. During this period, ten cells had been added to the nest, and instead of seventeen adults, only thirteen were on the nest. The others may have become easy prey to their enemies because of the conspicuous paint spots which I had placed on their bodies. The nest was attached to the ceiling about ten inches from two small ventilator-slits in one side-wall; through these slits the wasps came and went. On hot days, one, two or three wasps were stationed at these ventilators; they vibrated their wings rapidly for periods up to ten minutes. When the sun beat down upon the sheet-iron roof, it was indeed sweltering in there; hence I suppose this performance was for the purpose of cooling the nest, much after the manner of the trumpeter bees which ventilate the nests of bumblebees, or honey-bees that do the same at the entrance to the hive.

It is hard to see how this would be accomplished with the nest ten inches away; I sometimes wonder if the same behavior on the nest instead of at the opening would not do more good, but doubtless the wasps' judgment is better than mine in that. Their behavior agreed with that of other species of Hymenoptera which do their fanning at the hive entrance.

The incoming queens carried water, and placed much of it in large globules in the cells with the eggs or young larvæ. The lids of four sealed cells were thoroughly saturated with water, and another cell which had a concave instead of a convex cap had this cavity completely filled with water. This habit of spreading water on the outside of sealed cells was also noted for *pallipes* colonies elsewhere;⁶ this precaution may protect the pupae from drying up. These *P. rubi-*

⁶ See article to appear in Ecology, 1931, entitled "Polistes Wasps and their use of Water."

ginosis bring in large globules that glisten in their jaws as they fly. Sometimes if disturbed they lose their drops in flight or as they alight on the nest; by placing my notebook under the nest I have collected many such drops. At first I thought that the liquid might be a thin nectar, but when I substituted my tongue for my notebook, my taste told me it was clear water.

It is strange that so many of the wasps remained on the nest most of the time. In this colony of thirteen queens, from nine to thirteen were on the nest at all times; this means that sometimes none were out, and never more than four were out at one time. I could not understand why, with June still young, this group did not hustle to bring in pulp and increase the size of the nest. It appeared that they were merely waiting for the workers to emerge; with the first of their queenly instincts satisfied, they were remembering that they were queens, and now had only to await the vassals. Many of the larvæ were full-grown and ready to spin, and the younger larvæ could be sustained with only a few of the queens at work occasionally. While nine days ago only eight cells had been capped, today twenty-eight were capped. All this prospect of help from twenty-eight workers in the near future may account for the aristocratic languor of these queens.

With so many adults on the nest, it was hard to follow the activities of each, even though all bore distinguishing marks, but a few notes were so made. For instance, three certain wasps were seen more frequently than the others at the ventilating hole, vibrating their wings. "Red-thorax" gave special attention to inspecting the cells with larvae; "Blue-thorax" often left her ventilating post and flew afield, and when she returned to the nest the others would sip nectar or what not from her mouth. No paper pulp was being brought in now, and only a few shallow cells contained eggs. In one place instinct had miscarried; a cell with one-fourth grown larva contained also an egg, deposited a little below it. Since no cell is capable of bringing to maturity two larvæ, one must eventually perish.

The nest did not adhere well to the smooth iron ceiling, so when I attempted to pull off with the forceps a tightly

clinging queen, the whole nest crashed to the floor. I could not again fasten the nest to the metal ceiling, but since I had seen *P. pallipes* and *P. variatus* build again in the same spots after their nests had been taken, I hoped the same would occur here. Not knowing what to do with the nest, I placed it, open side down, on the shelf near the ventilating hole where the wasps would pass it on their way in and out. The wasps were furious for some time, and flew angrily about, and then one by one settled on the spot where the nest had been attached. After an hour, five queens left this congregation and assumed duties on the nest on the shelf. I left them with six wasps on the ceiling at the old site, and five on the nest on the shelf.

When their instincts are misled, one may expect almost anything. When I returned to the colony on June 23, I found the number of wasps complete, but they had left the ceiling and all were now at work on the nest on the shelf. Here, it seemed, would be something new in behavior; instead of all constructing a new nest, all now united in work on the old nest on the shelf, destroying it and carrying it out bit by bit. About fifteen cells had already been completely removed; the nest material and larvæ were being discarded, and even the capped cells were broken open and the pupæ carried out. Some of the queens would bite off pieces of the nest and drop them directly below, while others would fly out a distance and drop them while on the wing. One particular wasp would always drop her load below, six inches east, where already an accumulation of litter on the floor told of her diligence; another habitually dropped her loads toward the south. Eleven of the old, marked queens remained on the nest, but no new ones were there; this indicates that the maturing pupæ had been thoroughly destroyed.

The whole colony seemed to be demoralized, and several were seen eating and kneading the flesh of their own young. They were all restless, and appeared nervous and angry, working in helter-skelter fashion, destroying when they should be building, yet all seemed to be of one mind, intent upon demolishing the nest and its contents and getting it off the premises as soon as possible. At a short distance

from the nest, the chewing of paper pulp by the angry wasps sounded like the gnawing of a mouse in old papers. They were indeed as busy as they were angry, as they energetically poked their heads into the cells, as if in search for any that might remain. The larvæ seemed more the object of their wrath than the nest itself. The larvæ were always carried out and dropped at a great distance, while the bits of material were merely dropped below near by. Sometimes the larva was too heavy to permit a long flight; then the wasp would fly to the ground with it, but always drag it one to four feet away before abandoning it.

On June 30, a week later, they were still at the job; the nest was about two-thirds gone. Even two weeks later, July 14, a portion of the old nest still remained, with eight queens on board. They were unusually susceptible to intrusion, and one marked with green singled me out for attack during my entire stay of an hour. She stung me once, and came back to renew her attacks as often as I chased her out.

Perhaps their nervousness was increased by the fact that there was now a new nest also to be defended. On the ceiling, near the spot where the old nest had been, was the new nest with four of the queens on it. It was hexagonal in shape, and contained fifty-one cells, arranged in beautiful symmetry; the first row on one side had six cells, and the others in order contained 7, 8, 9, 8, 7 and 6 cells, respectively. Here they were at last doing what they probably would have done at first, had not the presence of the old, broken nest near by disconcerted them. They rebuilt the nest near the old site, just as *P. pallipes* and *P. variatus* had done elsewhere when their nests were removed.

By July 28 I found a thriving nest of eighty-two cells, all shallow, of course, each containing an egg, and every cell but the four newest ones at the edge had round, shiny pellets of honey. The globules in the cells varied in size and number. My sense of taste told me that these were really thin nectar, and not the drops of water which these wasps bring in when the larvæ are in an advanced stage or the cells are capped. Thus we find that this wasp pro-

vides honey for the first meal for the larvæ, just as do the other species of *Polistes*.⁷

Although eight or nine queens were on the new nest on the ceiling, they had not yet entirely abandoned the old one on the ledge. Three wasps, still wearing their identification marks, were on it, but all that was left of that beautiful nest of 175 cells was the mutilated stumps of about twenty-five cells. However, the wasps had tried to do something for the colony. Most of the cells contained eggs, but four cells had two eggs each, and two had three eggs. Perhaps it is no wonder their egg-laying instinct had gone astray amid such confusion.

The wasps guarded this new nest carefully. Only a few ventured out at any one time. Possibly they had something to fear from ants. A mouse made itself quite at home, running along the ledge nearby, not fearing even my presence; no doubt he would have made inroads on the eggs and larvæ if the guards had not been present.

We can readily see how *Polistes annularis*, coming back to the old home nest in the trees in the spring after a period of hibernation in a distant sheltered spot, can readily disseminate to similar branches near by. Obviously it is not so easy for *P. rubiginosis* to find nesting-places which fill her exacting requirements other than the immediate site of the parental nest. This difficulty, coupled with the innate tendency to return, probably accounts for the habit of nesting repeatedly near the same spot. In the photograph (fig. 1) the knot-hole⁸ affords an entrance to a colony of *rubiginosis* situated in the dark space between the inside and outside wall. The paper nest was attached to the horizontal beam. Horizontal and vertical studding

⁷ See article on "Honey Gathering Habits of *Polistes*." Biol. Bull. 54: 503-519, 1928.

⁸ The knot-hole is the scene of the observations on behavior described under the title, "At the end of the season with *Polistes rubiginosis*." (Ent. News 40: 7-13. 1929.) There I have shown how the inhabitants of the nest congregate in clusters about the opening with nothing to do but wait for the impulse to seek hibernating quarters. I failed, however, to include one note on the return of these wasps to this knot-hole the following spring, which I wish to add here, because it shows how after a period of hibernation elsewhere, the wasps (like *annularis*) remember the home site and return to it.

made a small, square room surrounding this hole. For three years, returning queens in the spring congregated in abundance about this opening. The second year another colony appeared up under the roof, and later others appeared in various parts of this old building, wherever a knot-hole or a crack was available. When finally the building was wrecked, I found eight such nests between the lath and the outer wall.

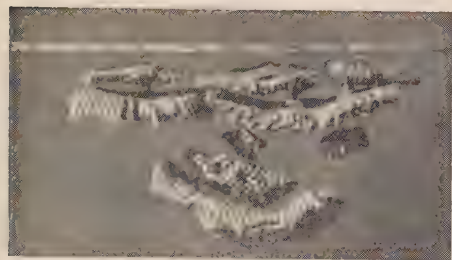
In two other distant localities in St. Louis County and Jefferson County the same condition prevailed and upon pulling off the boards which covered the nests I found in each several large combs which these wasps had built, one below another in true *Vespa* (not *Polistes*) fashion. In nest shown in fig. 2, each comb was attached to the one above by one or more pedicels, much after the manner of the comb attachment in nests of *Vespa*.⁹ On the floor of this little square enclosure lay several old nests which had fallen of their own weight. Because of crowded conditions and the scarcity of proper dark nesting sites, these wasps had built tier below tier on the old nest; they had not used the old soiled cells, but each time had built anew, just below. Another new departure in habit also was apparent here: they were salvaging and rechewing the paper in the old combs for material for the new ones, as can be plainly seen in the top three sections in fig. 2. This certainly seemed like an ingenious step in the direction of economy. It was interesting to note that in reducing these old nests to pulp, they used only the clean, soft cells, but did not attack the roofs; these were extremely tough, and were contaminated by the many larvæ that had grown in the cells. Moreover, if the roofs had been broken, the support of their nests would have been weakened.

I say that the combs, attached one below the other, remind me of the nests of *Vespa*. It is easy to imagine this as the beginning of a new habit of nest building in *rubiginosis*, or to conjecture that it is a revival of some ancestral habit.

Vespa usually adds sheets of paper to enclose the

⁹ A close-up of the same nest is shown in fig. 3.

combs. They make all of the combs in one season, instead of building a new comb each year. However, *Vespa*



FIGS. 2-5. For explanation see text.

*crabro*¹⁰ builds comb below comb in hollow trees, without paper covering-sheets, and builds the combs all in one

¹⁰ Buetenmuller. Trans. New York Entom. Soc. 6, plate 9, 1911.

season. The indications are that in the course of¹¹ evolution, *P. rubiginosis* is becoming, in nest-building habits, more like *Vespa crabro* than it is like any other species of *Vespa* or *Polistes*, because they build in dark and inaccessible places, and build comb beneath comb.

A nest was taken at Wickes on September 7, 1919. Two days later, I noticed that one capped cell had an incision, and further observation showed a parasite in the act of emerging. The cap was removed, and under it I found the shrivelled pupa of *P. rubiginosis* pushed up toward the capped opening, and one-third of the distance down in the cell was a second cap or partition. This proved to be the covering of a series of elongated cocoons, each containing



FIG. 6.

a parasite, *Christelia arvalis* Cress. [R. A. Cushman]. (fig. 6). In this particular case the host, despite parasitization, had succeeded in spinning its cap, but in four other cells in this nest infestation had occurred earlier, so the wasp larvæ had not the strength to spin their own coverings. Each parasite had spun its own cocoon; some had spun in nearly a horizontal position, others had spun in an upright position against the wall. The *Polistes* cells each contained about six cocoons of the parasite.

¹¹ When *rubiginosis* has sufficient room to build, the nests are very evenly made, and beautifully hexagonal in shape. When the conditions are crowded and space limited, the nests are made in various shapes, as shown in the collection of six in fig. 4. In fig. 3, which is another view of fig. 2, one can see more of the ill-shaped handiwork. However, if one looks closely in the center of the lowermost nest in the latter figure, one can see how the nest started out to be hexagonal, but the additions added to either side grew according to the available space.

ON SOME CARIBIDÆ, INCLUDING NEW SPECIES,
FROM THE MOUNTAINS OF NORTH CARO-
LINA AND TENNESSEE

BY P. J. DARLINGTON, JR.

In late August and early September, 1930, I collected with an expedition from the Museum of Comparative Zoölogy (of Cambridge, Massachusetts) on several of the mountain ranges of western North Carolina and eastern Tennessee. Probably because of the lateness and dryness of the season few phytophagous or other arboreal beetles were found. However, Carabidæ, in which I was chiefly interested, were abundant in suitable places, especially on the heavily forested slopes of the higher mountains, so that we (Prof. Nathan Banks, Dr. F. M. Carpenter, Mr. Gilbert Banks and myself) were able to secure about 1800 specimens of the family. Dr. W. S. Creighton and Mrs. Creighton collected about 400 additional Carabidæ at Little Switzerland, in the Black Mountains, North Carolina, also during the summer of 1930. This collection they have very kindly turned over to me. Study of these series of accurately labeled specimens has led to the recognition of several new species and subspecies, and it is chiefly to describe these novelties that the present paper is written. However, a few previously described local forms are discussed. It is hoped that the paper may help to stimulate coleopterists to collect and study the interesting fauna of the southern Appalachian uplands. Only when much more collecting has been done, and the specimens labeled accurately *and in detail*, can a comprehensive study of this fauna and of its distribution be undertaken.

I am indebted to the authorities of the Museum of Comparative Zoölogy not only for sending me with their expedi-

tion to the southern Appalachian region, but for permitting me to study the Coleoptera which were secured, and to refer to the invaluable type collections in the Museum. The authorities of the American Museum have very kindly allowed me to examine several types and other specimens in their care collected by Beutenmüller in the Black Mountains.

Scaphinotus viduus irregularis Beut.

Taken by us at about 6,000 feet on Mt. Mitchell, Black Mountains, N. C., and at 5,200 feet at Newfound Gap, Smoky Mountains, on the North Carolina-Tennessee state line. Three specimens in all, under stones and loose bark.

I have seen the type in the American Museum. This is a geographical subspecies of the more northern typical *viduus*, not an aberration as stated by Roeschke (1907, p. 145). *Irregularis* seems to be the only recognizable subspecies of *viduus*, for the series of *viduus* which I have examined from New England and other regions show conclusively that *leonardi* Harr. is not valid. All the characters given by Harris (1839, p. 193) to distinguish *leonardi* from *viduus* prove to be of a purely individual nature.

Scaphinotus confusus n. sp.

General form and structure of the subgenus *Irichroa* as defined by Roeschke (1907).

Color black, with variable æneus or purplish reflections above.

Head of the usual *Irichroa* type, but with the labrum less deeply emarginate and the eyes less prominent than usual.

Prothorax narrow, by actual measurement very slightly (about 10%) wider than long, but appearing as long as wide; about 1.6 times as wide as head. Sides bluntly angulate just before the middle, slightly convexly arcuate from lateral angles to anterior angles, slightly concavely arcuate and converging from lateral angles to basal angles, which are obtusely rounded. Base and apex slightly emarginate. Lateral margins very narrowly and evenly flexed from

base to apex; each margin with a seta at the lateral angulation and a second seta a little before (not in) the basal angle. Disc of pronotum irregularly punctate and transversely wrinkled especially near the base and sides, variably elsewhere. Disc with a deep basal and a shallower apical transverse impression, the two connected by a median longitudinal impressed line.

Elytra with humeri broadly rounded, nearly obliterated. Each elytron with about 16 punctured striae anteriorly, but with more, especially in the ♀, near and behind the middle. Striae frequently in part irregular, however, especially laterally and apically and along a well-marked zone between the 9th and 11th striae (as counted near the front of the elytron). Epipleuræ rather closely and coarsely, but not deeply, punctured.

Anterior tarsi of ♂ very narrowly dilated, sole of the basal joint with spongy pubescence only in apical one-fourth of its length.

Length: ♂, 22.5-24.5; ♀, 26-28 mm.

Type: ♂, Museum of Comparative Zoölogy, No. 16430, from Mt. Mitchell, Black Mountains, North Carolina, taken by myself, September 7, at about 6,000 feet altitude, under loose bark at the base of a dead conifer in damp forest. Allotype ♀ and 5 paratypes (♂ ♂ ♂ ♀ ♀) from "Black Mountains, N. C., Beutenmüller," dated from May to July. One ♂, which I have not made a type, was taken by myself between Newfound Gap and Clingman's Dome, 5,200-6,642 feet, in the Smoky Mountains, on the North Carolina-Tennessee state line, September 2. A pair of paratypes is in my own collection; all the other specimens mentioned are in the Museum of Comparative Zoölogy.

Scaphinotus confusus may be distinguished from the other species of subgenus *Irichroa* as follows:

- 1. Prothorax rather broadly margined, the margin expanded toward the base*S. viduus*
- Margin usually narrower, not expanded toward the base 2

2. Anterior tarsi of ♂ scarcely dilated, sole of first joint with spongy pubescence confined to apical $\frac{1}{4}$. Elytral striae confused from about the 9th to the 11th striae, the zone of confusion separated from the marginal area of confused punctuation by several regular striae. Size larger, all specimens seen over 22 mm. long 3

Anterior tarsi of ♂ more dilated, sole of first joint with spongy pubescence covering at least apical $\frac{1}{2}$, sometimes nearly whole sole. Elytra usually, but not always, without a zone of confused striae separated from the margin by regular striae. Size smaller, usually under 22 mm. 4

3. Prothorax both actually and proportionately wider, almost exactly twice as wide as head.....*S. guyoti*

Prothorax narrower, about 1.6 times as wide as head. Upon direct comparison the lateral margin of the prothorax is seen to be more abruptly and more narrowly reflexed, and the eyes to be less prominent than in *guyoti**S. confusus*

4. All other species of *Irichroa*

Beutenmüller included *confusus* in his conception of *guyoti*, and it is possible that he had specimens of *confusus* before him when he described *angelli* (1918, p. 89). However, since the entire description of *angelli* consists of a statement that it is merely a black color form of *guyoti*, since no type seems to have been designated, and since Beutenmüller's material is so scattered that it is impossible to say that he did not have a black *guyoti* in his series, it seems best to take his statement at its face value and consider *angelli* as really a black form of *Scaphinotus guyoti* Lec. (It is to be noted that *S. guyoti* and *S. confusus* cannot be separated by color.) By thus interpreting Beutenmüller's inadequate description literally, I think that much future confusion may be avoided, especially abroad.

Scaphinotus guyoti Lec.*(angelli* Beut.)

Not taken by the Museum of Comparative Zoölogy expedition. Described from "The Black Mountains of North Carolina . . . resembling in its characters *C. andrewsi*, but as large as *C. viduus*" (from original description, Leconte, 1866). The only specimens I have seen in addition to the type are a pair (♂ ♀) in the Blanchard Collection, Museum of Comparative Zoölogy, from Highlands, N. C. The relationship of this species to *confusus* Darl. (see key above) parallels very closely that of *S. andrewsi* to *S. germari*, as interpreted by Roeschke (1907).

It is to be noted that Roeschke did not know *guyoti*, but drew his description from those of several authors who failed to distinguish *confusus* from *guyoti*.

Nomaretus (Maronetus) unistriatus n. sp.

Of the general form and structure of the subgenus, sometimes called genus, *Maronetus*; *i. e.*, of the *imperfectus* group of *Nomaretus*.

Piceous black, strongly shining.

Head as usual in the subgenus, constricted just behind the eyes but expanded posteriorly to form a condyle.

Prothorax as long as wide, about 1.6 times as wide as head, widest about the middle; sides broadly arcuate in anterior $\frac{3}{4}$, converging but slightly sinuate before the obtuse basal angles; base and apex nearly squarely truncate. Disc of pronotum smooth and shining, with deep basal and shallower apical transverse impressions, the two connected by a median impressed longitudinal line; pronotum with also a short, deep sublongitudinal impression on each side near the basal angle. Raised lateral margin of pronotum very fine and even; each margin with two setigerous punctures, one about $\frac{1}{3}$ from apex and one a little before base.

Elytra widest well before the middle, outer margin strongly arcuate anteriorly, slightly and nearly evenly arcuate posteriorly to the pointed but not produced apex. All striae completely obliterated except the sutural, which

is represented in anterior $\frac{2}{3}$ of elytral length by a series of coarse, subconfluent punctures. Disc of elytra otherwise shining and impunctate, except that on the left elytron there are three and on the right two setigerous (the bristles can be detected in three of the five punctures, and are broken off in the other two) punctures in a position corresponding to the 4th interval in striate *Maronetus*. Subapital marginal setigerous punctures of elytra nearly obliterated, only one or two very small ones being visible on each elytron.

Epipleuræ and under surface of body shining, impunctate except for the usual orderly series of setigerous punctures.

Tarsi and palpi of ♂ unknown; those of ♀ normal for *Maronetus*.

Length: ♀, 7 $\frac{3}{4}$ mm.

Type: ♀, Museum of Comparative Zoölogy, No. 16431, from Highlands, N. C., June, 1888. In the Frederick Blanchard Collection, probably collected by Blanchard himself.

Nomaretus unistriatus is unique in the great reduction of the elytral striation, and probably also in the reduction of the marginal setigerous punctures near the apex of the elytra. Blanchard's specimen (my type) has been mentioned by Leng (1916, p. 42) as probably representing an undescribed species, but Leng did not describe it, because he was unable to determine the amount of variation normally occurring in species of *Maronetus*. Fortunately the series of over 50 specimens of *M. schwarzi* before me shows pretty conclusively that such variation is not extreme, so that I feel sure that *unistriatus* is a real species, not an individual variant of some striate form. In addition to the unique characters by which it may be recognized at a glance, *unistriatus* differs from *schwarzi* in having the dorsal surface not microreticulate, and from *imperfectus* (probably its closest relative) in having setigerous punctures on the elytra in a position corresponding to the 4th interval in the striate species.

***Nomaretus (Maronetus) debilis debilis* Lec.**

Taken by us in the Smoky Mountains at Newfound Gap

near 5,200 feet, and between the Gap and Clingman's Dome, near 6,000 feet. Both localities are on the North Carolina-Tennessee state line. Three specimens in all. These have the elytral striae less impressed and less heavily punctured, especially apically and externally, than the unique type of *debilis* from Georgia, but it would not be wise to describe a Smoky Mountain race until a larger series of both it and the typical form can be examined.

Nomaretus (Maronetus) debilis alpinus Beut.

Taken by us in the Black Mountains on Mt. Mitchell, 5,000-6,711 feet, and on Grandfather Mountain, 3,000-4,000 feet. Five specimens in all. This distinct form is stouter than *debilis*, with nearly impunctate elytral striae. It seems to be a geographical (northern) rather than an alticoline subspecies of *debilis*, notwithstanding the opinions of Beutenmüller (1903, p. 512) and of Roeschke (1907, p. 160) to the contrary, for in the Smoky Mountains nearly typical *debilis* ranges nearly as high as *alpinus* does in the Black Mountains.

Both *Nomaretus debilis* and its subspecies *alpinus* seem invariably to be found under stones and logs on the ground, not under loose bark or among dead leaves like most of our other eastern Cychnini.

Sphaeroderus multicarinatus n. sp.

Unusually elongate for the genus. Black, with bluish or purplish reflections on the head, prothorax, and outer margins of elytra.

Head as usual in the genus, except much more rugose than usual between the eyes, and usually with a strong, longitudinal puncture midway between the eyes.

Prothorax about 1.6 times as wide as head; appearing at least as long as wide, but by actual measurement about $\frac{1}{8}$ wider than long. Base slightly wider than apex. Sides evenly, not strongly, arcuate in anterior $\frac{3}{4}$, distinctly sinuate before the right or slightly obtuse posterior angles. Base and apex slightly emarginate; lateral margins nar-

rowly and evenly elevated, with a single setigerous puncture at middle. Pronotum with moderate basal and apical transverse impressions, with a fine longitudinal median impression from base to apex, and with a deep longitudinal fovea on each side extending from base more than $\frac{1}{3}$ to apex. Numerous punctures are grouped in and near the foveæ and across the base, otherwise the disc is smooth, impunctate, and shining.

Elytra widest behind the middle, sides more arcuate posteriorly than anteriorly. Each elytron with about 16 striae as counted across the middle of its length. Intervals 4, 8 and 12 cariniform, but often interrupted; intervals 2, 6 and 10 also often cariniform (especially in ♀) but usually lower and more interrupted; other intervals much lower and usually so much interrupted that they resemble series of small tubercles; apex and outer margin of elytron studded with small tubercles, the striae confused. Epipleuræ moderately closely and coarsely punctate.

Anterior ♂ tarsi broadly dilated, basal joint entirely pubescent below; ♂ palpi each with last joint expanded, as usual in the genus.

Length 14-17 mm.; width 5.8-7 mm.

All type specimens from the Smoky Mountains, as follows: holotype ♂, allotype ♀, and 23 paratypes (12 ♂ ♂, 11 ♀ ♀) from Newfound Gap, near 5,200 feet, on the North Carolina-Tennessee state line, August 30 to September 3, 1930. 7 paratypes (♂, 6 ♀ ♀) from between Newfound Gap and Clingman's Dome, 5,000-6,642 feet, on the same state line, September 2. 2 paratypes (♀ ♀) from State Road to Newfound Gap, Tennessee side, 3,500 feet, September 1. 3 paratypes (♂ ♂ ♀) from Deep Creek (Bryson City), North Carolina, 2,000 feet, August 23-26. Holotype, allotype and paratypes in the Museum of Comparative Zoölogy (No. 16432); paratypes in the writer's collection. All type specimens taken by the writer and the other members of the Museum of Comparative Zoölogy 1930 expedition, in forest, usually under loose bark, in rotten logs, or on the ground among dead leaves. I have seen other speci-

mens, which I have not made types, from Highlands, N. C. (Blanchard Collection, Museum of Comparative Zoölogy.)

This species may be distinguished from other *Sphærodeus* as follows:

Sides of prothorax near base broadly and distinctly,
though not strongly, sinuate; elytra with numer-
ous parallel carinæ *S. multicarinatus*

Sides of prothorax not sinuate, or, if sinuate, elytra
without distinct parallel carinæ

All other species of *Sphæroderus*

The exceptionally narrow prothorax, and strong puncture on the head midway between the eyes in *multicarinatus* are also useful diagnostic characters.

Multicarinatus is a geographical representative of *Sphæroderus bicarinatus* Lec., which it replaces in the Smokies. As species go at present in the genus, *multicarinatus* is a specific form, differing from *bicarinatus* (of which I have seen the type and numerous other specimens from the Black Mountains, N. C.) in being more slender, with the sides of the prothorax sinuate, with a constant puncture between the eyes (rarely present in *bicarinatus*), and with better developed elytral carinæ. However, I have seen intergrades between the two species—notably a specimen from Lake Toxaway, N. C., 3,000 feet, August 28, taken by myself. Notwithstanding Leng's (1961, p. 41) opinion to the contrary, I think that *Sphæroderus lecontei*, *bicarinatus*, and *multicarinatus* are all geographical representatives of a single stock, and that when the genus is revised upon a sounder basis, the last two forms should be considered as (very distinct) subspecies of *lecontei*. Until a revision can be undertaken, however, the three forms had better be kept apart.

***Nebria appalachia* n. sp.**

A member of subgenus *Nebria* s. str., group XI of Bänninger's (1925) "Die Nibriini."

Brownish to piceous black; legs, palpi, antennæ, and (usually) a pair of spots between the eyes flavous.

Head proportionately large, with unusually prominent eyes.

Prothorax cordate; about $\frac{1}{5}$ wider than the head across the eyes; just over $\frac{1}{2}$ wider than long; base slightly narrower than apex, nearly $\frac{1}{3}$ narrower than widest part; sides evenly arcuate in anterior $\frac{3}{4}$, strongly sinuate before the *acute* basal angles. Base and apex slightly emarginate; basal angles each with a setigerous puncture; lateral margins narrow, without setigerous puncture; Disc of pronotum not punctate; transverse basal and apical impressions and median longitudinal line present, and also a pair of short, linear basal foveæ just within the basal angles.

Elytra widest behind the middle, each elytron independently rounded at apex; humeri distinctly narrowed; elytra each with 8 well impressed striae, the striae faintly or not punctate, the 3rd interval with 3 or 4 large setigerous punctures. Inner wings about as long as the elytra.

Prosternal process margined except at extreme apex. Abdominal sternites 3 to 5 each, with a pair of single setæ near middle. Anterior tarsi of δ slightly dilated, the first 3 joints pubescent beneath.

Length 7.5-8.5 mm. Width 3.0-3.7 mm.

Holotype δ , allotype φ , and 43 paratypes from the Smoky Mountains, below Newfound Gap, Tennessee side, near 5,000 feet, August 30. 8 paratypes from the Black Mountains, Mt. Mitchell, N. C., near 6,000 feet (just above Camp Alice), September 5. Holotype, allotype, and paratypes in the Museum of Comparative Zoölogy (No. 16433); paratypes in the writer's collection. All specimens taken by the writer under stones on gravelly bars and banks of small mountain brooks.

The absence of the lateral marginal bristle of the prothorax and the presence of red spots between the eyes distinguish *appalachia* from all our other species of *Nebria* s. str., group XI (cf. Bänninger, l. c.) except from *pallipes*. From the latter *appalachia* may be known at once by its much smaller size, proportionately smaller prothorax and

larger head, and especially by the acute rather than obtuse basal angles of the prothorax. *Appalachia* is one of our smallest, perhaps really our smallest, *Nebria*, and is apparently a strictly alticoline species. Careful search at 3,500 feet along the banks of the very stream, on the upper reaches of which the type series (Smoky Mountains) was collected, did not yield a single specimen.

***Pterostichus (Gastrellarius) unicarum* n. sp.**

Small, slender, but slightly ventricose; dark brown or piceous, antennæ, palpi, tarsi, and apices of tibiæ rufous.

Head with two setigerous punctures over each eye; eyes moderately prominent; antennæ long and slender; mentum tooth entire, elongate, triangular, bluntly pointed at apex.

Prothorax by actual measurement very slightly wider than long; $1\frac{1}{3}$ times as wide as head; somewhat constricted toward base; base slightly narrower than apex, $\frac{2}{3}$ as wide as widest part; sides evenly arcuate in anterior $\frac{3}{4}$, rather strongly sinuate before the rectangular basal angles; lateral margin very fine and even; base margined, but sometimes indistinctly so at middle. Pronotum with basal and apical transverse impressions faint, connected by a deeper, longitudinal impressed line on middle of disc; later basal foveæ linear, extending from base $\frac{1}{3}$ or less toward apex; surface of pronotum impunctate even about the foveæ.

Elytra more than $\frac{1}{4}$ wider than the prothorax $\frac{2}{3}$ to $\frac{1}{2}$ longer than wide; striae entire, not or just detectibly punctate; 3rd interval with a single setigerous puncture at or just behind the middle. Inner wings atrophied.

Anterior tarsi of ♂ slightly dilated, first 3 joints pubescent below; apex of last ventral segment with 1 bristle on each side in ♂, 2 in ♀.

Length 6.2-7.5 mm. Width 2.5-3 mm.

All specimens from the Smoky Mountains, as follows: Holotype ♂, allotype ♀, and 33 paratypes from Newfound Gap, North Carolina-Tennessee state line, 5,000-5,200 feet. 4 paratypes from State Road to Newfound Gap, Ten-

nessee side, 3,500 feet. 13 paratypes from Deep Creek (Bryson City), N. C., 2,000 feet. All specimens taken by myself. Holotype, allotype, and paratypes in the Museum of Comparative Zoölogy (No. 16434); paratypes in the writer's collection. The Deep Creek specimens were washed from piles of drifted trash along the banks of the creek; they may have been carried down from higher altitudes. All the other specimens were taken among loose dead leaves (*not* in compact leaf mold) on the ground on forested slopes.

The name I have used is derived from that of the Unica Mountains, of which the Smoky Mountains are a part. I completely failed to find this species outside of the Smokies.

The various species of the subgenus *Gastrellarius* of *Pterostichus* may be tabulated as follows:

1. Base of pronotum with numerous scattered punctures; average size larger; only 1 setigerous puncture over each eye in *honestus* and probably in Casey's three species—

<i>honestus</i> Say	<i>scolopaceus</i> Csy.
<i>atronitens</i> Csy.	<i>deficiens</i> Csy.

Base of pronotum not punctate; average size smaller; 2 setigerous punctures over each eye..... 2

2. Base of pronotum distinctly (and by actual measurement) wider than apex; form stouter and more convex; head proportionately smaller; elytral striae as a rule more distinctly punctate; length 5.0 (*teste* Casey)-6.8 mm. *blanchardi* Horn

Base of pronotum distinctly (and by actual measurement) narrower than apex; form more slender, much as in *honestus*; other characters opposed to those above; length 6.2-7.55 mm. *unicarum* Darl.

I know Casey's three species only from description. I am indebted to Mr. L. L. Buchanan for pointing out to me the interesting reduction of the supraocular setæ in *Gastrellarius honestus*. The presence of an entire mentum tooth in this subgenus is also noteworthy.

Pterostichus, subgenus or section *Monoferonia* Csy.

Casey 1918, p. 363

Excellent series, including all previously described and several new forms in this subgenus, are before me, so that it seems desirable to publish a complete review of the species. The treatment of *Monoferonia* as a group of full generic rank seems to me to be unjustified. I prefer to treat it merely as a natural subgenus or section of *Pterostichus*, as is done in the Junk Catalogue (Csiki 1930, p. 674). Among the other *Pterostichini*, *Monoferonia* may be characterized as follows:

Body slender, convex, black or piceous, very highly shining; mentum tooth deeply emarginate at apex; two bristles over each eye; prothorax never much constricted at base, the basal angles obtuse, often rounded at apex; inner basal stria of pronotum deep and linear, outer shorter, often deeply obliterated; elytral striation complete except that the scutellar stria is nearly or quite obsolete; a single dorsal puncture on inner edge of third elytral interval behind the middle (two punctures on one or both sides in rare individuals); inner wings atrophied; met-episternum short; sides of body below with or without (variation largely individual) scattered, shallow punctures; anterior tarsi of ♂ dilated, joints not oblique; ♂ palpi slender; last ventral abdominal segment of ♂ modified.

The species are difficult, but I think may be distinguished by the following table:

1. Elytral striae shallow, distinctly punctuate near base, intervals perfectly flat near apex; last ventral of ♂ only slightly modified. 1. *primus* n. sp.

Elytral striae more impressed, not distinctly punctulate, intervals distinctly convex even at apex (less so in typical *maneus*, in which, however, the ♂ last ventral is characteristically modified—see description below) 2

2. Outer basal fovea of pronotum nearly or quite obsolete, basal angles rounded at apex; last ventral

of ♂ with sculpture consisting of a large, apical, transverse impression, oval in form, and bounded anteriorly by a curved, transverse, subcariniform elevation 2. *diligendus* Chd.

Outer basal fovea usually (not always) well impressed, about $\frac{1}{2}$ as long as inner fovea; basal angles of prothorax sometimes rounded apically, sometimes more abrupt; sculpture of ♂ last ventral not as described above 3

3. Last ventral of ♂ with a small but distinct, bubble-like, sometimes slightly transverse tubercle set in the middle of a weak, post-median depression; basal angles of prothorax rounded apically.

Striae of elytra lightly impressed apically (Ga.)

3a. *mancus* Lec. (typical)

Striae deeply impressed at apex (N. C.)

3b. *mancus plethorus* subsp. n.

Last ventral of ♂ weakly impressed behind the middle, with a weak, transverse elevation at extreme apex; basal angles of prothorax scarcely rounded apically.

Sides of prothorax distinctly, usually strongly, sinuate before the base; body stouter (Black Mountains region, etc.) 4a. *carolinus* n. sp.

Sides of prothorax not or very slightly sinuate before the base; form more slender (Smoky Mountains).....4b. *carolinus fumorum* subsp. n.

"*Monoferonia*" *idahoanus* Csy. (1924, p. 78), of which I have apparent topotypes, is nothing but *Pterostichus sphodrinus* Lec. It lacks the dorsal puncture of the elytron characteristic of the subgenus *Monoferonia* (Casey himself notes this fact), and belongs in subgenus *Hypherpes*, or possibly *Leptoferonia*, by Casey's own table (1918, pp. 320-).

Since all our species are mutually similar in appearance and in most points of structure, the following brief descriptions are all that are necessary to characterize them. I shall take the commonest and best known species, *diligendus* Chd. (*osculans* Csy.), as a basis for comparison of the others. All of the species are found under stones and logs in damp forests.

1. *Pterostichus (Monoferonia) primus* n. sp.

Of usual form and appearance for the subgenus; sides of prothorax oblique and usually slightly sinuate before the basal angles; latter only minutely rounded at apex, and therefore more abrupt than in *diligendus*; outer basal stria of pronotum nearly or quite obliterated; elytral striae comparatively little impressed, distinctly punctulate in basal $\frac{1}{2}$, intervals slightly convex anteriorly, completely flat in posterior $\frac{1}{3}$; last ventral of δ slightly impressed behind the middle, with a very weak transverse ridge adjacent to the apical margin.

Length 10.0-11.3 mm. Width 3.6-4.0 mm.

Smoky Mountains at comparatively low elevations: holotype δ , and 2 ($\varphi \varphi$) paratypes' from Deep Creek (Bryson City), N. C., near 2,000 feet; 2 ($\delta \varphi$) paratypes from State Road to Newfound Gap, Tennessee side, 3,500 feet. All collected by myself. A pair of paratypes is in my own collection; the rest of the type series, in the Museum of Comparative Zoölogy (No. 16435).

2. *Pterostichus (Monoferonia) diligendus* Chd.

(1868, p. 334)

osculans Csy. (1884, p. 2)

apalachius Horn (1892, p. 41)

appalachius (as corrected by) Csy. (1913, p. 132)

Of usual form and appearance for the subgenus; sides of prothorax oblique, rarely just perceptibly sinuate, before the basal angles; latter more broadly rounded at apex than

in most *Monoferonia*; outer basal stria of pronotum either obliterated or very weak; elytral striae deep, only rarely with even the slightest trace of punctulation; elytral intervals definitely convex even at apex; the last ventral of ♂ with a large, subapical, transverse impression which is bounded anteriorly by a pronounced transverse ridge.

Length 10.7-14 mm. Width 4.0-5.0 mm.

Range at least from the lower slopes of the White Mountains of New Hampshire to Virginia (Pennington Gap) and possibly to North Carolina (1 ♀ from Linville, doubtfully determined), and west (*teste* Casey 1924, p. 78) to Priest Lake, Idaho. Common in some localities.

There seems to be no doubt that Chaudoir's *Feronia* (*Evarthrus*) *diligenda* is a species of *Monoferonia*, and I am reasonably sure that it is the present species, in spite of Chaudoir's later opinion (*cf.* Horn 1892, p. 41) that the name is a synonym of *mancus* Lec. *Mancus* and the present species, like all *Monoferonia*, resemble each other so closely, especially in the absence of males, that Chaudoir might easily have considered them identical, even upon a comparison of specimens, and we do not even know that he had an opportunity for direct comparison. Setting aside Chaudoir's later opinion as of no certain value, then, we have the following statements in the original description of *diligenda* which, in combination, I think can refer only to the present species: the basal angles of the prothorax are obtuse, with the apices rounded; the inner basal fovea of the pronotum is recurved along the base and the lateral margin, where it is obliterated (this description fits some of my specimens but not others); the elytral striae are smooth and deep through their entire length; and, most significant of all, the ♂ last ventral has a transverse oval impression near the posterior margin. The species under discussion is the only *Monoferonia* known to me to which this last statement really applies. Casey (1918, p. 363) points out that Chaudoir mentions a depression on the ♂ last ventral but not a more anterior transverse ridge, and evidently concludes that the ridge would have been mentioned if it had been present and that since it is not men-

tioned, *diligenda* must be distinct from *osculans*, which has such a ridge. This, of course, is merely another example of Casey's specious reasoning—its weakness becomes strikingly evident when it is pointed out that Casey, in his own original description of *osculans*, mentions only the depression, not the ridge, of the ♂ last ventral. It may be added that the present species is the commonest and most widely distributed *Monoferonia*, and that its range is the most easily accessible, facts which increase the probability that it is what Chaudoir had in hand.

3a. *Pterostichus* (*Monoferonia*) *mancus mancus* Lec.

(1852, p. 234)

Form as usual in the subgenus; sides of prothorax oblique, sometimes just detectibly sinuate, before the posterior angles; the latter rounded at apex as in *diligendus*; outer basal stria of pronotum sometimes well marked and $\frac{1}{2}$ as long as inner stria, sometimes almost obsolete; elytral striae less impressed than in any other *Monoferonia* except *primus*, intervals barely convex near apex, though more so anteriorly; striae not punctulate; last ventral of ♂ with a small, abrupt, rounded or sub-transverse, bubble-like tubercle set in the center of a very weak postmedian depressed area; tubercle smaller but distinct in the single ♀.

Length 11.0-11.8 mm. Width 3.9-4.4 mm.

Known to me only from Leconte's original series of three specimens (♂ ♂ ♀) from Georgia. A fourth (♀) specimen from the same locality, associated by Leconte, is *Pt.* (*Monoferonia*) *carolinus* (see below). In order to avoid confusion, I have labeled and here designate Leconte's first specimen (a ♂) as the type of *Pterostichus mancus* Lec. Type number: Museum of Comparative Zoölogy 16439.

3b. *Pterostichus* (*Monoferonia*) *mancus plethorus*

subsp. nov.

Precisely similar to typical *mancus* except that the striae of the elytra are deeply impressed, with the intervals

much more convex even at apex; last ventral of ♂ as in typical *mancus*; last ventral of ♀ usually (but not invariably) showing the ♂ sculpture in reduced form, *i. e.* with a minute, abrupt, bubble-like tubercle about $\frac{1}{3}$ or $\frac{1}{4}$ from the apex of the segment, but usually *not reaching the apex*. Females of other *Monoferonia* often have a less abrupt, longitudinal, *apical* elevation on the last ventral.)

Length 10.0-13.0 mm. Width 3.6-4.6 mm.

Holotype ♂, allotype ♀, and 81 paratypes (47 ♂♂, 34 ♀♀) all from the Black Mountains, Mt. Mitchell, North Carolina, 5,000-6,711 feet, taken by the writer and the other members of the museum expedition. Holotype, allotype, and paratypes in the Museum of Comparative Zoölogy (No. 16436); paratypes in the writer's collection.

This species (*mancus* and subspecies *plethorus*) seems to be the only one in which the sculpture of the ♀ last ventral is of assistance in identification, but the character is not to be depended upon even here, for it varies somewhat.

4a. ***Pterostichus (Monoferonia) carolinus carolinus* n. sp.**

Of usual appearance for *Monoferonia*; sides of prothorax rather strongly sinuate before the basal angles; the latter obtuse but almost right, rather abrupt, rounded only at extreme apex; outer basal stria of pronotum usually about $\frac{1}{2}$ as long as inner, but sometimes partly obliterated; elytral striae deep, not punctulate, intervals strongly convex even at apex; ♂ last ventral weakly impressed behind the middle, with a weak transverse elevation contiguous to the apical margin.

Length 11.2-12.3 mm. Width 3.9-4.5 mm.

Holotype ♂, allotype ♀, and 29 paratypes, (18 ♂♂, 11 ♀♀), from the Black Mountains, Little Switzerland, N. C., about 3,400 feet, all taken by Dr. W. S. Creighton, August 9 to September 10. In addition to the types I have seen 1 ♀ from Linville, N. C., September 8 (Creighton); 3 ♂♂ (not quite typical) from Black Mountain City, N. C., 2,700 feet (taken by myself); and 1 ♀ from Georgia in the Leconte Collection. Paratypes are in the collection of the writer; all other specimens mentioned are in the Museum of Comparative Zoölogy (type No. 16437).

The sculpture of the ♂ last ventral of this species resembles that of *primus*, but the other characters of the two species are very different.

4b. **Pterostichus (Monoferonia) carolinus fumorum**

subsp. nov.

Similar to typical *carolinus*, but a little smaller, with the sides of the prothorax only slightly or (usually) not at all sinuate before the basal angles; the latter therefore more obtuse than in typical *carolinus*, but still not nearly so rounded as in *diligendus*; ♂ last ventral as in *carolinus*.

Length 10.1-12.0 mm. Width 3.7-4.5 mm.

Holotype ♂, allotype ♀, and 17 paratypes (6 ♂♂, 11 ♀♀) from the Smoky Mountains, between Newfound Gap and Clingman's Dome, along the North Carolina-Tennessee state line, 5,000-6,642 feet, September 2, all collected by the writer. Strangely enough, the species was not found near Newfound Gap itself. Several paratypes are in the writer's collection; the rest of the type series is in the Museum of Comparative Zoölogy (No. 16438).

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A CUBAN VERMILEO

BY WILLIAM MORTON WHEELER

In a brief note¹ I recently recorded the occurrence in Cuba of a very handsome species of the Rhagionid genus Vermileo. Knowing my interest in these insects, one of my students, Mr. Richard P. Dow, brought me 30 living larvæ which he had collected August 28 and 29, 1930, from their pitfalls in the sand under overhanging limestone cliffs at Mayari (2800 feet) and San José (900 feet) in the Trinidad Mountains of the southern part of that island. Three of the larvæ pupated after I had transferred them to fresh sand. Two failed to yield imagines, but in late October a somewhat crippled male fly issued from the third, and was readily identified as belonging to *Pheneus tibialis*, described by Walker some eighty years ago from Jamaica.² This insect is of unusual interest, both on account of its peculiar larval habits and because it is the type of Walker's genus *Pheneus*, which now becomes merely one of the numerous synonyms of *Vermileo*. In the note above cited I also called attention to the existence of yet another species of this genus, taken by H. H. Smith at an altitude of 7000 feet in the State of Guerrero, Mexico. This form was described by Williston in 1895³ as *Arthrostylum fascipennis*, but was later⁴ regarded by him as synonymous with Walker's *Pheneus tibialis*. The description, however, shows that it must be a different species of *Vermileo*. Of this genus, therefore, we now know four widely and discontinu-

¹ In "Demons of the Dust," W. W. Norton, New York, 1930, p. 275.

² *Insecta Saundersiana*. Vol. I, Diptera. London, 1850-1856, p. 156, Pl. 4, Fig. 3.)

³ Two Remarkable New Genera of Diptera, Kansas Univ. Quart. 4, 1895-1896, pp. 107-109.

⁴ Biol. Centr. Diptera, 1, 1901, p. 264.

ously distributed species in the New World, namely *V. comstocki* Wheeler of California, *opacius* Coquillett (possibly only a variety of *comstocki*) of California and New Mexico, *tibialis* Walker of Jamaica and Cuba, and *fascipennis* Wiliston of Mexico. The only other species, the genotype *V. vermileo* Linn., is confined to the Mediterranean region.⁵

On the approach of winter the larvæ collected by Mr. Dow were placed in a cold room and not brought into the heated laboratory till April 1, 1931. They at once became active, excavated fresh pitfalls and greedily seized and sucked the juices out of the ants, termites and meal-moth caterpillars with which they were provided. Some of them pupated in late May and several perfect flies of both sexes emerged during the period from June 10 to July 5. A day or two before emergence the brown, sand-incrusted pupa wriggled up through the sand till one or two millimeters of its anterior end projected into the air, and a few hours before emergence vigorously thrust its entire body out till it lay freely exposed on the surface. Then, usually in the early morning, the exquisite imago escaped from the pupa-case and was able to fly within two or three hours. It is a very delicate, short-lived, positively heliotactic insect which, unless very carefully handled, loses its legs quite as readily as many crane-flies (Tipulidæ).

Comparison of my Cuban specimens with Walker's brief description of the Jamaican *V. tibialis* reveals certain slight differences which are scarcely more than varietal or sub-specific. Walker, however, was not noted for the adequacy of his dipterological descriptions, so that the recovery of the true Jamaican *tibialis* must be awaited before the precise status of the form discovered by Mr. Dow can be determined.

⁵ The South European, Balearic and Egyptian localities in which this species is known to occur are listed in the "Demons of the Dust" (pp. 147-150). I there predicted its occurrence in Sicily, unfortunately overlooking the fact that it had already been taken at Taormina on that island by my friend Horace Donisthorpe (The Ants [Formicidæ] and some Myrmecophiles of Sicily. Ent. Rec. 38, 1926, pp. 161-165, 39, 1927, pp. 6-9; and the Guests of British Ants, London, 1927, p. 120, fig. 21.)

Vermileo tibialis (Walker)var. **dowi** var. nov.

Female (living). Length 11-12; wing 9.5-10 mm.

Surface of body shining; rich fulvous yellow, with olive green eyes; face densely white pollinose; ocelli black; front and posterior surface of head dark brown, covered with grayish yellow dust. This becomes glistening white on the inferior posterior surface. Proboscis, palpi and antennæ pale yellow, the terminal antennal joint fulvous yellow, the arista white with blackish tip. Thoracic dorsum reddish, the mesonotum with a pair of narrow, ill-defined brown vittæ; scutellum, metanotum, pleuræ and coxæ and four abbreviated longitudinal lines on the anterior half of the mesonotum glistening white pollinose in most specimens. Abdomen with the posterior half of the tergites obscurely brownish, terminal segments and valves darker; venter anteriorly flesh-colored, sides whitish. Fore and middle legs yellow, paler than the hind legs, which are fulvous; the three terminal tarsal joints of all the legs, the distal three-fifths of the hind tibiæ and a long spot near the apex on the extensor surface of the hind femora, black. Wings smooth and glossy, their anterior borders broadly bright fulvous yellow shading into grayish posteriorly, their tips and a median transverse band, broadest near the costal border, blue black or blackish slate-colored; veins fulvous, blackish in the dark areas. Halteres fulvous yellow. Thorax and wings hairless; abdomen and legs, especially the hind pair, with extremely short and minute pubescence; orbital cilia white, short and inconspicuous.

Face and front narrow, linear, parallel-sided, of equal width. First antennal joint slender, at least twice as long as broad, second joint as long as broad, third joint slightly narrower than the second, oval, nearly twice as long as broad; arista distinctly segmented, somewhat longer than the remainder of the antenna. Thorax robust, very nearly as broad as the head, at least through the wing-insertions, and about one and one-half times as long as broad, very convex dorsally, rectangular anteriorly. Wings rather

narrow; venation much as in *V. comstocki*, but the anterior branch (R 4) of the third longitudinal vein is more curved at the tip, the fourth posterior cell (M 3) is closed near the wing margin, forming a very short M 3 + Cu vein, and the apex of the first anal cell is so greatly contracted as to be almost closed. In *V. vermileo* the tips of the fourth posterior and first anal cell are contracted but not closed. Fore and hind tibiæ with a single stout spur; middle tibiæ with two spurs. Abdomen long and narrow, tapering at the tip; genital appendages small, the outer pair short and broadly excised distally, with rather acute anterior tips.

Male (living). Length 9.5-10 mm.; wing 8 mm.

Differing from the female in its smaller size and more slender stature, the thorax being decidedly narrower than the head and less convex dorsally, and the abdomen much more slender and clavately enlarged at the tip, though the genitalia are small. Face and front not narrower than in the female, but the two basal joints of the antennæ are distinctly broader, shorter and more flattened.

Mounted specimens of this fly soon lose their rich fulvous color and become dull reddish and the eyes dark brown. The glistening white dust on the thorax and coxæ is absent or poorly developed in some recently emerged individuals.

According to Walker the male of the Jamaican *tibialis* measures 4 lines (8.3 mm.) though the wings measure 7 lines (about 12 mm.). The former measurement may be readily explained as due to the shrinkage of the abdomen in drying, but the latter exceeds that of the females of the Cuban specimens. The Jamaican form, moreover, seems to have an entirely black antennal arista, the halteres having dark-colored knobs, the markings on the wings are brown instead of blue-black, and there is no dark spot near the apex of the hind femora. Walker's figure shows two spurs on the fore and hind, as well as on the middle tibiæ, but this may be a draughtsman's error.

Williston's description shows that the Mexican *Vermileo fascipennis* differs from *tibialis* in having the face bare, the dorsal portions of the three antennal joints as well

as the arista, three posteriorly confluent stripes on the mesonotum, the pleuræ and the basal portion of the first (second?) abdominal segment, black. This segment has a yellow spot on each side. The hind femora, except their tips, the median portion of the hind tibiæ and the tip of the second joint of the hind tarsal are also black. The fourth posterior and anterior anal cell are closed as in *tibialis*, but the hind tibiæ have two spurs as in *V. vermileo*. The markings on the wings resemble those of the Jamaica *tibialis* in being brown, but the extreme tips seem to be pale. Williston's specimens were males measuring 10-12 mm., and were therefore as large as females of the var. *dowi*.

NOTES ON THE TICK, *ORNITHODOROS TALAJE*
(GUER.), INFESTING A HOUSE IN
THE CANAL ZONE

BY LAWRENCE H. DUNN

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On February 27, 1929, while at Gatun, Canal Zone, I learned through conversation with Dr. R. P. Curry, Assistant Chief Health Officer of the Canal Zone, and Sanitary Inspector C. A. Roach, of the Gatun District, that a short time previously the occupants of one of the houses at Gatun had complained of their quarters being infested with ticks that were biting them and causing considerable annoyance. They had collected several specimens of these ticks and brought them to the office of the District Physician at Gatun. From there they were sent to the Board of Health Laboratory, at Ancon, Canal Zone, where they were identified as *Ornithodoros talaje*.

Although I had been giving considerable attention to *O. talaje* in Panama for a number of years, this was the first time that I had learned of any definite reports of this species attacking man. Neither had I heard of their being found in houses in the terminal cities of Panama and Colon or in the American villages in the Canal Zone, although many of the rats captured in these places are usually heavily infested with the larval forms of this species. Nymphal and adult forms had been collected only in native huts in some of the interior villages where they were generally found in company with numerous *Ornithodoros venezuelensis* Brumpt. In view of these facts I was greatly interested to learn of this species being present in a dwelling at Gatun and attacking man and wishing to observe the conditions that prevailed, Dr.

Curry, Mr. Roach and I visited the infested quarters. The house was one of the regular Canal Zone type of four-family wooden quarters, and it was in one of the two downstairs apartments that the ticks were located. The occupant of this apartment was an American family, consisting of Mr. X, his wife and a ten year old son.

Mr. X was a civilian employee of the U. S. Army and had been occupying these quarters for a period of about three months. The previous occupant, so far as known, had made no complaint of being annoyed by arthropods in the house.

The X family began to be attacked soon after moving into the apartment. Since these attacks seemed to occur only at night and while in bed, it was at first suspected that the apartment was infested with bedbugs. A search was made which failed to reveal any bedbugs, but did result in several of the ticks being found.

The furniture in the house was all supplied through United States government channels, but there were two single beds in one room that had been used by the former occupant. Believing that these beds might be the source of infestation, Mr. X placed them in a storeroom and purchased new ones.

At the time of our visit, Mrs. X gave me a bottle containing ten of the ticks. These had been found during the thirty-three days that had elapsed since the previous lot had been collected and sent in for identification. Four of these were apparently second stage nymphs and six appeared to be in the third stage. All were flat and seemingly unfed and none had molted while in the bottle. Several of these specimens had been found on the white spreads covering the beds and the family believed that they were dropping from the ceiling.

The bedroom was lined with narrow matched pine boards and had been well painted. There were many crevices between the boards, however, that would provide hiding places for *Ornithodoros*, but a close search aided with flashlights and probing along in the crevices with tooth-picks gave only negative results.

The two single beds, which were of iron, that had been placed in the storeroom were examined, and two cast

nymphal skins of *O. talaje* were found in a joint in one of the frames.

Upon inquiry regarding the presence of rats in the house, Mrs. X informed me that when they first moved into the apartment, the place was badly infested with them. Efforts were at once made to get rid of these rodents. A carpenter closed all rat holes that could be found in the apartment. That these efforts proved to be successful was evidenced by the fact that no rats had been seen for some time.

On April 6th, Inspector Roach visited the house, and at this time was given a bottle containing twelve of the ticks. These were also second and third stage nymphs, and had been collected during the thirty-eight days since our former visit.

On May 29th, I again visited the house, and at this time Mr. X was suffering from the effects of the bites of three of these ticks. Two of his fingers were badly swollen and were in bandages. The third bite was on his back and had produced a severe local reaction with swelling, considerable irritation and several large wheals appeared in the surrounding area. Two of the ticks had been found a few days before my visit and both of these were third stage nymphs. Mr. X stated that he had taken one of these ticks after it had dropped on one of the beds from the ceiling. Mrs. X claimed that she had swept several from the cracks in the floor of the bedroom.

On September 20th one more tick was received. This was an adult male that had been taken while feeding upon Mr. X.

No more specimens were received from this house, and upon making inquiries a few weeks later I was informed that the family were no longer being bitten and that no more ticks were being found in the apartment.

The twenty-five ticks that I received from this house probably fell short of the total number that was found during that time. It is quite reasonable to believe that many more were destroyed when found and not collected alive.

I am of the opinion that rats were responsible for bringing the *O. talaje* to this apartment. It is quite probable

that after the rodent hosts had been either destroyed or prevented from returning to their hiding and nesting places in the apartment, the engorged larvæ that had dropped from them had, after molting and becoming nymphs, been forced to seek their blood meals from the human inhabitants. Since the larvæ of this species remain attached to the host for several days while engorging and none in this stage had been observed by the X family, it is reasonable to believe that if larvæ had hatched from eggs deposited in the house they were not existing upon human blood.

It seems rather remarkable that during the time these ticks were present in the X apartment, the other parts of the house seemed to be free of them. The families occupying the other three apartments stated that they had not been bitten by the ticks and none had been found in their rooms.

Observing the effects produced on Mr. X by the bites of these ticks I fed seven of them on my left forearm in order to study the reaction upon myself. There was a considerable delay in getting them to start feeding, but after they began taking blood they all became well engorged and secreted coxal fluid. The longest time required by any of the seven to engorge was sixteen minutes. Five of them were induced to feed by placing them one at a time in a tube applied to the same spot on my arm. Thus all five fed on the same site and each of the last four apparently used the same tiny puncture made in my skin by the first one. The reaction from these bites consisted of a slight swelling with a well-marked hæmorrhagic area surrounding the site of each bite and accompanied by a severe itching which occurred at intervals during the three or four days following the bites. Naturally the effects produced by the multiple bites at the same site were much more pronounced than at the sites of the two single bites. Since the reaction I experienced was so much less severe than in the case of Mr. X, I am led to believe that there is a considerable difference in the susceptibility of individuals to the effects of bites from these ticks.

My thanks and appreciation are due Dr. D. P. Curry for information regarding this house infestation, and to

Sanitary Inspector Roach for his kindness in visiting the house on several occasions to secure information and ticks for me.

A NEW SPECIES OF CHRYSOPA

BY NATHAN BANKS

New species of this genus are so uncommon in our country today that the finding of one of the most distinct forms hitherto known merits a separate article.

Chrysopa eureka sp. nov.

A heavy-bodied *Chrysopa* like *robusta*, but mostly dark and of quite different markings and venation.

Head pale yellowish, unspotted; palpi black; antennae black, basal joint pale. Thorax dark grey, heavily marked with black, underside and pleura mostly black. Pronotum with eight black spots arranged in two transverse rows, black spots on lateral lobes of the meso—and metanotum. Legs dull yellowish, a black band before tip of each femur, and the tarsi somewhat darkened. Wings with mostly black cross-veins, gradates, and apical forks, the longitudinal veins with streaks of black; stigma greyish, with several cross-veins behind margined with dark.

Face broad; antennae rather short and stout; pronotum very broad, but little narrowed in front; rest of thorax very broad; abdomen stout and short; legs stout, much more so than in the common species, the front and mid tarsi more than one-half the length of the tibiae.

Wings moderately broad; venation not dense, about 17 costals, eight connecting veins from the radial sector to radius, seven cubital cross-veins beyond third cell, divisory veinlet ends much beyond the cross-vein, divisory cell of moderate size, about five gradates in each series, the two rows not very near together and the outer one hardly nearer to the margin than to the other row. Length fore-wing 17mm, breadth 5.5mm.

From Hope, Ark., 22 Aug. (L. Knobel), at light. Holotype in Museum of Comparative Zoology.

NEW ANTS OF THE GENUS *MACROMISCHA*

BY C. G. AGUAYO

Museum of Comparative Zoölogy

The ants of the remarkable genus *Macromischa*, besides being among the most beautifully colored of the Formicoidea, are certainly very interesting on account of their extremely localized habitat.

W. M. Wheeler in a recent paper on this genus (1931) has described several new forms, among which were several Cuban species that I had the pleasure of sending to him. As I still have some undescribed new varieties recently collected by Dr. Pedro Bermudez, Colonel George Natenzon and myself, I avail myself of the opportunity given me by the Guggenheim Memorial Foundation to study in the United States, and Dr. Barbour's permission to work in the Museum of Comparative Zoölogy, to publish this small contribution to the knowledge of Cuban ants.

Wheeler raised to generic rank (1931, p. 4), the subgenera *Cræsomymex* and *Antillæmymex*, both of Mann (1920, p. 408), but since among the species described further on *Macromischa wheeleri petri* shows intermediate characteristics between *Macromischa* s.s. and *Cræsomymex*, he agrees with me in placing them anew as subgenera.

The position of *Antillæmymex* as a genus was more uncertain on account of the intermediate characters shown by some species (Wheeler, loc. cit. p. 4), and it seems to be convenient to consider it again as a subgenus.

I cannot but thank Prof. Wheeler and Dr. Bequaert for their many helpful suggestions during the preparation of this paper.

Macromischa barbouri-sp. nov.

Worker. Length 4 mm.

Head (without mandibles) about $\frac{1}{4}$ longer than broad, suboval, with rounded posterior corners, broader behind, sides convex. Eyes rather large, oval, situated at the middle of the sides of the head. Mandibles with five distinct teeth. Clypeus convex, with a distinct short and narrow longitudinal carina. Frontal carinae short. Antennae somewhat stout, scapes strongly curved at base, surpassing the occipital corners; first funicular joint as long as the two succeeding joints, joint two larger than broad, joints 3-7 slightly transverse. Club 3-jointed, well defined, last joint about as long as the two preceding together.

Thorax stout, less than twice as long as broad, humeri of pronotum large, with rounded angles. No thoracic sutures. Epinotal spines slender, divergent, almost straight, slightly curved downward, about 3.5 times as long as their distance apart at base.

Pedicle long and slender, about as long as the epinotal spines, and three times as long as the node; acutely toothed antero-ventrally. Node in profile about twice as high as long, compressed antero-posteriorly, anterior surface moderately convex, posterior flat; from above two and one-half times broader than long; the upper border twice as broad as the base. Post-petiole in profile decidedly longer than the petiolar node; anterior surface straight, broadly rounded; from above sub-campanulate, about $1\frac{1}{5}$ times as broad as long. Gaster with the first segment slightly longer than broad.

Legs stout, femora strongly swollen at the middle; tibiae rather incrassated.

Thorax, gaster and appendages very shiny; head moderately so. Mandibles and clypeus coarsely, longitudinally striated. Head minutely and densely punctate, with sinuous longitudinal, interrupted rugae. Thorax coarsely rugose, the rugae being transversely irregularly sinuous on dorsum, longitudinally sinuous on pleurae, and transverse

on epinotal declivity. Petiole, postpetiole, gaster and legs minutely punctate.

Hairs white, stiff, erected, moderately abundant, longer on thorax.

Head green, thorax red, with violaceous and greenish reflections in certain lights. Epinotal spines brownish red. Pedicel, base of femora and tip of tarsi yellowish brown. Petiolar node, post-petiole, gaster, remaining of legs and antennæ black.

Described from a single specimen collected by Colonel G. Natenzon in "Pan de Guajaibon," province of Pinar del Rio, Cuba.

Holotype in the collection of the M. C. Z.

This species is related to *M. squamifera* Roger and *M. creightoni* Mann, but readily distinguishable by the longer epinotal spines, coarser sculpture and by the red coloration of the thorax.

It is with pleasure that I name this species for Dr. Thomas Barbour, to whom I am very much indebted for many favors.

***Macromischa manni* Wheeler var. *villarensis* var. nov.**

Worker. Length 5.2 to 5.8 mm.

This form has the same size, sculpture and pilosity as *M. manni*, differing principally by the shape and position of the epinotal spines which in var. *villarensis* are somewhat smaller, much more divergent, V-shaped, closer together at their bases, lacking the sigmoidal curve of *manni*, directed backward, upward and slightly bent inward at their tips; the basal half of each spine is broader and laterally compressed, the dilatation ending abruptly at the middle as in *M. porphyritis* var. *latispina* Wheeler.

Described from many specimens collected by Pedro Bermudez in several localities of Northern Santa Clara, Cuba. They were on limestone cliffs, "with the gaster bent and upraised" (Bermudez).

Type locality: "La Puntilla," Remedios, Santa Clara, Central Cuba.

Also from "Palenque de Taguayabon" in the same region. Named for "Las Villas," a popular name for the said region.

Cotypes in the M. C. Z. and in the author's collection.

***Macromischa (Antillamyrmex) torrei* sp. nov.**

Worker. Length 2 mm.

Head longer than broad, rectangular, with evenly convex sides, straight posterior border and rounded occipital corners. Eyes convex, situated before the middle of the sides of the head. Clypeus convex, with rounded anterior border. Frontal carinæ parallel. Frontal area indistinct. Mandibles with denticulate, concave apical border. Antennal scapes scarcely reaching the posterior corners of the head; funicular club large, 3-jointed, longer than the remaining funiculus; joint 2-7 broader than long.

Thorax short, as long as the head with mandibles, broader in front than behind, with regular slightly convex profile, without dorsal thoracic sutures. Epinotal spines about as long as the epinotal declivity, and longer than their distance at the base, directed backward and upward, and very slightly curved downward.

Peduncle short, with a small tooth on its anteroventral surface. Node longer than broad; its anterior declivity in profile slightly concave, its summit flattened, and its posterior declivity almost straight. Postpetiole large, twice as broad as long, almost as broad as the gaster, and three times as broad as the petiole behind, in profile convex above. Gaster small, about as long as the thorax.

Legs small, femora feebly incrassated.

Surface of body shining, head and thorax densely and finely punctate. Gaster smooth. Appendages very finely punctate and shining.

Pilosity scarce. Hairs white, short, erected and scattered on the body; minute on scapes and legs.

Color uniformly testaceous.

Described from one specimen found alive among land shells given to me by Dr. Carlos de la Torre, and it is a

great honour to me to associate his name with this interesting species. The shells were collected by Bermudez in "Buenavista," Remedios, Santa Clara Province, Cuba.

The *holotype* is deposited in the M. C. Z.

This small species is typically an *Antillæmyrmex* and similar in size and coloration to *M. flavidula* Wheeler and Mann from Hayti, but it is very easily separated by its sculpture, shape of petiolar node, shape of the head, position of eyes, etc. It can not be confused with any other species of this genus.

Macromischa* (*Cræsomymex*) *aguayoi natenzoni

subsp. nov.

Worker. Length 3.6 mm.

This subspecies is very closely related to the typical form, but differs by the punctations of the head, which are more abundant in the occipital region; by the less shiny surface of the head, and by the sculpture of the thorax. The thoracic rugæ are longitudinally and regularly disposed both on sides and dorsum, instead of being regularly longitudinal on sides, coarse and irregularly longitudinal on pronotum, irregular on meso and epinotum and transverse on epinotal declivity, as occurs in the typical *aguayoi*.

The color is blue as in the typical form the head being slightly greenish.

Described from one specimen given to me by G. Natenzon, who collected it on a limestone cliff at Guajaibon, the highest mountain in the province of Pinar del Rio, Cuba.

The *holotype* is in the M. C. Z.

***Macromischa* (*Cræsomymex*) *barroi* sp. nov.**

Worker. Length 4 mm.

Head longer than broad, with rounded occipital corners. Eyes situated at the middle of the sides of the head. Mandibles 5-toothed, with slightly convex external margin. Clypeus convex posteriorly and impressed at middle. Frontal carinæ slightly divergent. Frontal area deeply

impressed, with a median carinula. Antennæ slender, scapes extended far beyond the occipital corners, first funicular segment as long as the two following together; all the remainder longer than broad; club 13-jointed.

Thorax about 2.2 times as long as broad, broadest at the pronotum. Meso- and epinotum roof-shaped.

Peduncle of petiole short and stout, shorter than node, with a distinct antero-ventral tooth, very convex above, evenly concave below. Node broader than petiole, evenly curved both in front and behind. Post-petiole slightly longer than broad.

Legs long; femora strongly incrassated.

Surface of the body entirely shining. Scapes finely striated; head densely punctate, except the occipital border and corners; cheeks and mandibles rugose. Thorax rugose; rugæ longitudinal on sides, irregularly longitudinal on pronotum and mesonotum and transverse on epinotal declivity. Sides of petiole with radiating rugæ. Post-petiole, gaster and legs smooth. Hairs white, pointed, erected, scattered over the body and appendages.

Head, thorax and petiole deep metallic green. Head with bluish reflections. Post-petiole, gaster and appendages black.

Described from several specimens found on limestone cliffs at "Soroa," Province of Pinar del Rio, Western Cuba. (Aguayo, coll. IV 1931). Numerous specimens which I refer to this form were taken at "El Mamey," Cayajabos, Pinar del Rio, on limestone cliffs, by P. Bermudez, M. Jaume and G. Aguayo.

Cotypes of this species are in the M. C. Z. and in the author's collection.

I have named this form for my friend M. Barro, an amateur entomologist.

This species belongs to the group of *M. aguayoi* to which it is very closely related, but it can be separated by the following characters: thorax broader; pedicel higher, much more convex above and more evenly concave below; petiolar node longer than broad and more evenly curved in front; head less densely punctate on the posterior half. Sculpture

of thorax different. Pilosity more abundant, hairs shorter and stiffer. Coloration different. Gaster and post-petiole less shining.

Agrees with *M. aguayoi* var. *archeri* Wheeler in the punctuation of the head and shape of the post-petiole, but differs by the shape of the petiole, sculpture of the thorax, pilosity and color.

Santschi recently described (1931), another species of this group: *M. bierigi*, which comes from "Vinales" the type locality for *archeri*, but the description of *bierigi* agrees so much with the cotypes of *archeri* that I have examined, that if not the same it is only a variety of *M. aguayoi* very close to *archeri*.

***Macromischa wheeleri petri* subsp. nov.**

Worker. Length 4.5 mm.

Head longer than broad, sides slightly convex, posterior corners rounded. Eyes situated at the middle of the sides of the head. Mandibles with 5 teeth. Frontal carinæ short and slightly divergent behind. Antennæ slender, scapes surpassing the occipital corners, first funicular joint slightly longer than broad, club 3-jointed, terminal joint a little shorter than the two preceding together. Clypeus rounded, anterior border concave.

Thorax about $2\frac{1}{2}$ times as long as broad, epinotum armed with a pair of short blunt divergent spine-like tubercles, which are much shorter than their distance at base.

Peduncle of petiole curved, as long as node, with a small blunt tooth beneath in front. Node in profile as long as high, convexly rounded above. Post-petiole campanulate, about as long as broad. Femora incrassated, tibiæ somewhat so.

Body and appendages very shining. Head with sparse piligerous punctures.

Mandibles and cheeks triated, scapes finely so. Thorax and epinotum coarsely rugose. Rugæ sinuous on pronotum, transverse on meso- and epinotum. Petiole longitudinally rugose at sides.

Body and appendages with sparse erected white hairs. Color of body dark brilliant green.

Described from many workers found in several localities of Santa Clara, Central Cuba, by Pedro Bermudez. "They were found walking on big limestone rocks apparently nesting under them."

Type locality: "La Vigia," Mayajigua, Santa Clara.

The *cotypes* are in the M. C. Z. and in the author's collection.

I have also specimens from "El Yigre," Caibarién; Seibabo de Yaguajay, and Chambas.

Named for my friend Pedro Bemudez, its discoverer.

This form is very remarkable on account of the short epinotal spines, which show a transition between the subgenera *Macromischa* s.s. and *Croesomyrmex*. The presence of spines is characteristic of the former, but all the remaining characters are those of *M. wheeleri*, which is the genotype of *Croesomyrmex*.

The female of *wheeleri* has also short epinotal spines, and it is to be noted that intermediate characters have been found in a form of the type species of *Croesomyrmex*.

Differs from the typical form of the species by the presence of epinotal spines, and by its color which is more deeply green. In all the specimens of *wheeleri* in the collection of M. C. Z., the color is brownish green.

***Macromischa foreli* nom. nov.**

Macromischa petiolata (Forel). Emery, *Genera Insectorum*, 1920, p. 245 (nec *M. petiolata* Mayr, 1868).

Macromischa petiolata Wheeler, *Bull. M. C. Z.* 72, 1, 1931.

Leptothorax petiolatus Forel, *Ann. Soc. Ent. Bel.* 45, 1901, p. 229.

This species was described by Forel as *Leptothorax petiolatus*, in 1901, from specimens collected by Wheeler at "Cuernavaca," Morelos, Mexico, with the suggestion that it might be considered as a *Macromischa*. Emery (1920)

transfers it to the said genus, an opinion accepted by Wheeler (1931). Unfortunately the name was preoccupied by *Macromischa petiolata* Mayr (1868, "Die Ameisen des baltischen Bernstein"). It is true that Mayr's species was transferred by Wheeler (1914) to a new genus, *Noto-myrmica*, but the necessary application of the rules of nomenclature forces us nevertheless to reject any *homonym*, even in the case of so well established a species.

Therefore, I suggest that this species bear the name of the celebrated Myrmecologist. I hope, nevertheless, that in the near future, when a better knowledge of the mainland *Macromischa* allows us to include them in another genus, Forel's species may again bear its original name.

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NEOPANORPA HIRSUTA (CRAMPTON)

BY F. M. CARPENTER

Museum of Comparative Zoology

In a recent paper dealing with the morphology of the Mecoptera, G. C. Crampton figured the genitalia of a specimen from India and suggested that "this remarkable Panorpid should be called '*Panorpa hirsuta*,' if it should prove to be new to science." At my request, Professor Crampton kindly sent the specimen to me for further study, and since he did not publish a complete description of the insect, which belongs to the small genus *Neopanorpa* rather than *Panorpa*, I have prepared the following redescription of the species.

Neopanorpa hirsuta (Crampton)

Figure 1

Panorpa hirsuta Crampton, 1931, *Psyche* 38, p. 10; fig. 23.

Body reddish brown, except for eyes and first four abdominal segments, which are black; horn on third segment short, extending to about the middle of the fourth segment; seventh and eighth abdominal segments subequal, a little shorter than the sixth. Fore wing: length, 14 mm.; width, 3.7 mm.; membrane hyaline, bands and spots light brown; apical band entire, pterostigmal band forked posteriorly; basal band interrupted; a single basal spot. Markings of hind wings similar to those of the fore. ♂ genitalia: genital bulb rather broad, reddish brown; forceps short, with a prominent basal tooth and covered with extraordinarily long, black hair; hypovalves long, with a rounded basal prominence on the inner margin and a slender apical projection on the outer margin.

Holotype (♂): Mysore, India; in Museum of Comparative Zoology.

This insect is readily distinguished from all described males of the genus by the remarkable development of the hairs on the genital forceps. These hairs are so prominent that they can easily be seen without the aid of a lens. Three Indian species of *Neopanorpa* have been described from females alone (*zebrata*, *flava*, *ocellaris*), but even allowing

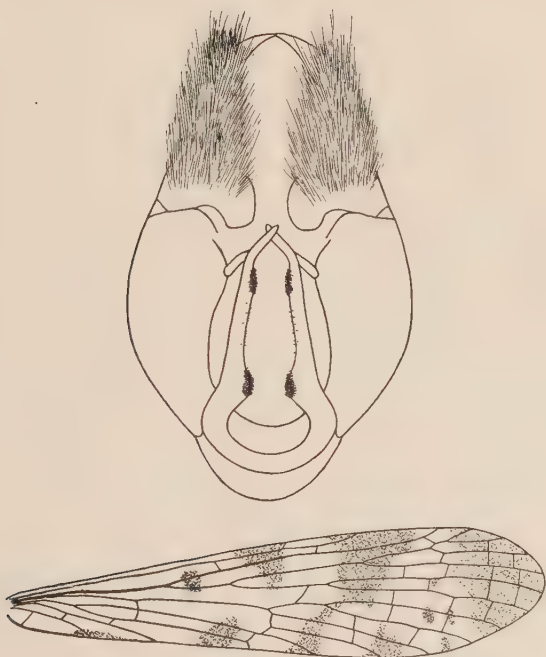


FIG. 1. *Neopanorpa hirsuta* (Crampton), genital bulb and fore wing of ♂ holotype.

for the usual variation in the markings, the differences between the wings of these species and the wings of *hirsuta* clearly show that we are dealing with a distinct species. The wings of *zebrata* (Travancore) are traversed by a number of narrow stripes; those of *ocellaris* (Sikhim) are mostly a dark, smoky brown, with a few small hyaline spots; and those of *flava* (Sikhim) have a reddish yellow membrane. The wings of *hirsuta* are hyaline, as in *zebrata*, but the markings are very different, as shown in Fig. 1.

NOTES ON HIPPOBOSCIDÆ

3. HIPPOBOSCIDÆ OF YUCATAN

BY J. BEQUAERT

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The following notes are based mainly upon material obtained in 1929 and 1930 by the Expedition to Yucatan, organized by the Department of Tropical Medicine of Harvard Medical School, under the auspices of the Carnegie Institution of Washington, D. C., and under the leadership of Dr. George C. Shattuck. In Yucatan the Hippoboscidae are of peculiar interest, inasmuch as one species has been suspected or incriminated as the vector of a human disease.

Subfamily Olfersiinae

Olfersia coriacea van der Wulp

Olfersia coriacea van der Wulp, 1903, "Biol. Centr.-Amer.," Dipt., II, p. 430, Pl. XIII, figs. 2 and 2a (described doubtfully as ♀; according to Austen, both specimens seen by v. d. Wulp were males; in part: only the specimen from Mirandilla, Guatemala).

Pseudolfersia coriacea Austen, 1903, Ann. Mag. Nat. Hist., (7) XII, p. 265 (selects van der Wulp's male from Mirandilla as the holotype; states that the male from Presidio, Mexico, is *Olfersia propinqua* Walker). Aldrich, 1905, "Cat. North Amer. Dipt.," p. 656. Speiser, 1907, Ent. News, XVIII, p. 104.

Pseudolfersia meleagridis Lutz, Neiva and da Costa Lima, 1915, Mem. Inst. Osw. Cruz, VII, p. 179, Pl. XXVII,

fig. 3 (no sex given; on domestic turkey, *Meleagris gallopavo*, in Pernambuco and Sao Luiz do Maranhao; on *Tinamus solitarius* Vieillot in Minas Geraes or Espiritu Santo; all localities in Brazil).

Colonia Santa Maria (near Puerto Morelos), in the northern part of the Territory of Quintana Roo, May, 1929 (G. C. Shattuck). This specimen was received from a Maya hunter, who said he found it on an ocellated turkey, *Agriocharis ocellata* (Temminck). Territory of Quintana Roo ("Herrera, 1919, said to cause a disease in man."—U. S. Nat. Mus.).

I have also seen specimens from Peten, Guatemala (Oliver Ricketson, Jr.; as "bay-sore fly," received through Dr. Thomas Barbour); Uaxactun, Peten, Guatemala, off *Crax globicera* (Linnæus), April 15, 1931 (J. Van Tyne); Upper Chagres River, Panama, off turkey (U. S. Nat. Mus.); Rio Colorado, Bolivia, off *Penelope* sp. (W. M. Mann.—U. S. Nat. Mus.); and Pernambuco, Brazil, off turkey (received from Dr. Ad. Lutz as *P. meleagridis*.—U. S. Nat. Mus.).

The following characters may aid in separating *O. coriacea* from other closely allied species of *Olfersia*. Frons rather narrow, very little wider than an eye. Posterior orbits and postvertex about equally produced behind, the orbits short and divided from the hind margin of the postvertex by a very shallow sinus. Postvertex with a slight transverse depression, dividing it into a short, anterior, dull, alutaceous area and a much longer, posterior, smooth and shiny area. Fronto-clypeus not covering nearly the whole palpi; its apical, interantennal portion rather narrow and not striate; the free, terminal arms short and broad, not appreciably grooved above. First basal cell (*R*) long and narrow, nearly parallel-sided in its apical half; second basal cell (*M*) long, the second section of the fourth longitudinal vein (*M1+2*) being about as long as the first section of the fifth (*M3+Cu1*); third and fourth longitudinal veins (*R4+5* and *M1+2*) not setulose; first longitudinal

vein (*R*1) ending in the costa opposite or basad of the small anterior cross-vein (*r-m*).

I synonymize *Pseudolfersia meleagridis* with *O. coriacea* after carefully studying the description as well as a specimen (probably a cotype), at the United States National Museum, received from Dr. Ad. Lutz. In connection with the possible rôle of *O. coriacea* as a carrier of human leishmaniasis (see below), the statement by Lutz, Neiva and da Costa Lima that their *P. meleagridis* occasionally attacks man, is of particular interest.

Olfersia mexicana Macquart (1843, Mém. Soc. Sc. Agric. Arts Lille (1842), p. 435; 1843, "Dipt. Exot.," II, 3, p. 278. —No sex; Mexico), is possibly the same as *O. coriacea*. If the identity of these two species could be established beyond doubt, Macquart's name would have to be used.

The correct wild host or hosts of *O. coriacea* in Central and South America deserve to be more carefully investigated. Mr. J. Van Tyne's specimen from *Crax globicera* is the first Central American record for which the zoological identity of the host is beyond question. I am therefore under particular obligation to Mr. J. Van Tyne for the privilege of studying this and other hippoboscids collected by him on his recent trip to Guatemala.

In the Peninsula of Yucatan, there are four gallinaceous birds that might possibly serve as hosts to *O. coriacea*. (1) The ocellated turkey, *Agriocharis ocellata* (Temminck), "*pavo del monte*" in Spanish and "*Kutz*" in Maya (according to Gaumer), is perhaps the most common of the four and is particularly abundant in Quintana Roo. (2) The crested curassow, *Crax globicera* (Linnæus), usually called "*Pahuil*" by the natives of Mexico and Guatemala, is a much rarer bird, though occasionally seen in Quintana Roo.¹

¹ According to a note by the late Dr. G. F. Gaumer (quoted by Boucard, 1883, Proc. Zool. Soc. London, p. 459), the flesh of *Crax globicera* is highly valued as food by the Maya; but the bones are always carefully kept away from the dogs and cats, as they are said to be very poisonous. E. W. Nelson described the young of *C. globicera* as *C. chapmani*. He says that the Maya Indians call this bird the "*Kambul*," whereas they designate the adult as "*Bolonchan*" or "*Bolonchana*."

(3) The bare-throated guan, *Penelope purpurascens* Wagler, "cojolito" in Spanish and "Kosh" in Maya (according to Gaumer), is very rare in Quintana Roo. (4) The chacha or chachalaca, *Ortalis vetula pallidiventris* Ridgway, "Bach" in Maya, a much smaller bird than the others, is abundant, particularly in Quintana Roo.²

The main interest of these birds and their fly parasites lies in their possible connection with the etiology of "bay-sore" or human cutaneous leishmaniasis, a disease of man in the humid, densely forested areas of the Yucatan Peninsula (Territory of Quintana Roo and the southeastern part of the State of Campeche), British Honduras (Belize), and Guatemala (Peten). As a rule the sores are found on exposed parts of the body, and they are particularly frequent on the ears. It can hardly be doubted that some biting insect is the transmitter, but no experiments have as yet been published showing which particular species is involved. Various insects are blamed by the inhabitants of the infected regions. One opinion which enjoys much local popularity, in Yucatan and northern Guatemala, incriminates the bird-fly of the ocellated turkey or of the bare-throated guan. During my visit at Merida, Dr. Abalardo Lara N. showed me some specimens of the fly in question, in which I recognized *Olfersia coriacea*. He also stated that he had transmitted leishmaniasis through the bite of this fly and exhibited some photographs to support his claim.¹ This theory deserves, at any rate, to be investigated with care; even though it seems more likely that in Yucatan, as elsewhere in the New World, cutaneous leishmaniasis is transmitted by one or more species of *Phlebotomus*.

² I am under great obligations to Mr. Ludlow Griscom for valuable information concerning these birds. The Spanish names here given for the various gallinaceous birds apply only to Yucatan. In other parts of Central America they may be used for different birds. I have been unable to find out which species is known more specially as "faisan," a name sometimes heard in Yucatan.

¹ A discussion of the possible carriers of human leishmania sores in Central America has been given by Farfan y López, E. 1922. "La leishmaniosis americana o 'ulcera de los chicleros.'" (Merida, Yucatan), 27 pp. Page 13 of this pamphlet shows a reproduction of a photograph of *Olfersia coriacea*, in ventral and dorsal aspect.

Entomologists acquainted with the habits of the Hippoboscidae might perhaps object to the *Olfersia* theory of leishmaniasis that these flies, as a rule, are not prone to bite man after leaving their normal host. Thus C. M. Wenyon (1911, Parasitology, IV, pp. 292 and 299), in the course of his studies of human Oriental sore at Bagdad, found that the dog-fly (evidently *Hippobosca capensis* v. Olfers, although no name is given), will bite human beings, but that this is an uncommon occurrence. He was only bitten on two occasions, though he lived in close association with a number of dogs, all of which had many of these insects about them. Wenyon did not succeed in inducing these flies to feed on cases of Oriental sore in man. They very quickly died if kept in confinement away from a dog. It is possible, however, that certain species of Hippoboscidae attack man more readily than others. The European *Cratærina pallida* (Latreille), a common parasite of swifts, for instance, has been observed repeatedly in Germany biting human beings, even indoors, either during the day or at night in bed. Similar observations have been made in France.¹

Olfersia vulturis van der Wulp

Olfersia vulturis van der Wulp, 1903, "Biol. Centr.-Amer.," Dipt., II, p. 429, Pl. XIII, figs. 1-1a (♀ ?; off a vulture; Rio Sucio, Costa Rica). J. Bequaert, 1926, "Med. Rept. Hamilton Rice 7th Exp. Amazon," p. 240. Ferris, 1928, Ent. News, XXXIX, p. 36, figs. A-B (larva).

Chichen Itza, common on the black vulture, *Catharista urubu* (Vieillot), although not all birds are infested. One bird shot on June 1st was free of flies; another, examined the next day, had eight parasites. In Yucatan the black vulture is known as "*sapilote*" in Spanish and as "*Tchom*"

¹ See: Erich Hesse, 1919, JI. f. Ornithologie, LXVII, p. 408-409; 1920, Zeitschr. Wiss. Insektenbiol., XVI, p. 33; 1929, *Loc. cit.*, XXIV, pp. 70-71. Also E. Christeller, 1924, *Loc. cit.*, XIX, p. 103; J. Guiart and Lesieur, 1912, Paris-Médical, Dec. 12; and F. Moutier, 1928, Ann. Paras. Hum. Comp., VI, pp. 105-106.

or "*Chom*" in Maya. One specimen of *O. vulturis* was also obtained off a sparrow-hawk at Chichen Itza, by Dr. J. Sandground, February 15, 1929.

I have fully discussed this species in 1926. I regard *O. vulturis*, *O. fossulata* Macquart and *O. spinifera* (Leach) as valid species, separable by structural characters.

Subfamily Melophaginae

Lipoptena mazamæ Rondani

Lipoptena mazamæ Rondani, 1878, Ann. Mus. Civ. Genova, XII, p. 153 (♀; South and Central America; off "*Cervus mexicanus*"). Speiser, 1904, *Loc. cit.*, XLI, p. 334. Aldrich, 1905, "Cat. North Amer. Dipt.," p. 653. Ferris and Cole, 1922, Parasitology, XIV, p. 185, figs. 2A and 2E (♀♂). Ferris, 1930, Canad. Entom., LXII, p. 70. Falcoz, 1930, Encycl. Entom., B, Dipt., V (1929), p. 51.

Lipoptena depressa var. *mexicana* C. H. T. Townsend, 1897, Ann. Mag. Nat. Hist., (6) XX, p. 289 (♀♂; Paso de Telaya, Vera Cruz, Mexico; off white-tailed deer, *Cariacus virginianus* var. *mexicanus*); 1897, Trans. Texas Ac. Sci., II, 1, p. 41. Van der Wulp, 1903, "Biol. Centr.-Amer.," Dipt., II, p. 432. Speiser, 1904, Ann. Mus. Civ. Genova, XLI, p. 334. Aldrich, 1905, "Cat. North Amer. Dipt.," p. 653. Speiser, 1907, Ent. News, XVIII, p. 103. Bezzi, 1916, Natura, Riv. Sc. Nat., VII, p. 178.

Lipoptena depressa mazamæ Bau, 1930, Konowia, IX, p. 211, fig.

Lipoptena conifera Speiser, 1905, Zeitschr. Syst. Hym. Dipt., V, p. 354 (♀♂; off *Cariacus rufus* Ill. var. *simplicicornis* Ill., from South America, without more definite locality); 1908, Zeitschr. Wiss. Insektenbiol., IV, p. 304.

Lipoptena surinamensis Bau, 1930, Stettin. Ent. Zeitg., XCI, 2, p. 175 (♀♂; without host; Macaraibo, Surinam).

Chichen Itza, several females and males, off a "deer," February 10, 1930 (obtained from a native hunter by Dr. G. C. Shattuck).

It is unfortunately not possible to state whether the host of these parasites was the brocket or the Yucatan deer; possibly both animals harbor this *Lipoptena*. The brocket, *Mazama pandora* Merriam, "corzo" in Spanish and "Yuk" or "Yuk-keh" in Maya, has short, unbranched antlers in the male. The Yucatan deer, *Odocoileus toltecus* (H. de Saussure) (= *yucatanensis* Hays), "venado" in Spanish and "Keh" or "Kieh" in Maya, has, in the male, antlers with a few ramifications. Both are widely distributed in Yucatan and are known to occur near Chichen Itza. Ferris records *L. mazamæ* from *Mazama sartorii reperticia*, in Panama (collected by L. H. Dunn), and Bau from *Mazama nemorivaga*, in Bolivia.

I have also seen many specimens of *L. mazamæ* from "deer," obtained at Peten, Guatemala; Kartabo, British Guiana; and Manaos, Amazonas, Brazil. No structural differences can be detected among the four series studied. Rondani mentioned no locality for his type; but, since it came from Bellardi's collection and the host was given as "*Cervus mexicanus*," it was evidently obtained somewhere in Mexico.

My interpretation of *L. mazamæ* is the same as that of Ferris and Cole, who saw specimens from Yacuiba, Bolivia, and from Chiriqui Province, Panama. The species is distinct on structural characters from *Lipoptena depressa* (Say). On the other hand, Townsend's lengthy description of his var. *mexicana* fits, in all essential details, specimens of *L. mazamæ*. Color characters are not of specific value in this genus; they are liable to change in life after hatching, as well as after death, and they may differ according to whether the specimens are kept in a fluid or preserved dry. Moreover, Townsend's notes on the color were written largely from memory. One of the few structural features mentioned by Townsend is the shape of the male organ, which is said to be "moderately stout and blunt at tip." This would seemingly describe the "inner ring-like

piece" of the male genitalia of *mazamæ* as figured by Ferris and Cole.

So far as one can judge from Speiser's description, his *L. conifera* is likewise a synonym of *L. mazamæ*. The head is described as follows: "Der Kopf ist durch eine ganz ausserordentlich kurze Stirnstrieme charakterisiert, die wenig mehr ist als ein matter querer Spalt zwischen dem Scheiteldreieck und der sehr breiten Lunula." The unusually wide frontal lunule, with consequent shortening of the medio-vertex (or frontalia), must have been accidental, either due to the mode of preservation or to the incomplete retraction of the ptilinum within the lunule.

There is also nothing in Bau's description of his *L. surinamensis*, supposedly from Surinam,¹ that does not apply to our many specimens of *L. mazamæ* from Yucatan, Guatemala, British Guiana, and Brazil. Bau writes: "In der Bildung des zweiten Abdominal-Tergits gleicht diese Form den amerikanischen Arten *Lipoptena depressa* Say, var. *mexicana* Townsend, *mazamæ* Rondani und *conifera* Spieser. Die beiden ersteren haben auf dem membranösen Teil des Abdomens zwei kleine querliegende Chitinplättchen, welche der *L. surinamensis* fehlen. *L. mazamæ* ist auch kleiner, nur $2\frac{1}{4}$ bis $2\frac{1}{2}$ mm. lang." The length of dry specimens of *L. surinamensis* is given as 3.25 to 3.9 mm. in the female and about 3 mm. in the male. I am unable to find any trace of transverse chitinous plates on the membranous portion of the abdomen (dorsally) in my several lots of *L. mazamæ* (preserved in alcohol). In the Yucatan lot the females measure from 2.8 to 4 mm. Of course, in both sexes dry specimens give no correct idea of the size of a hippoboscid fly, and in the female the size also depends upon the condition of the larva contained in the abdomen.

¹ I have been unable to locate a locality "Macaraibo" on any of the South American maps I have seen. Perhaps the locality was really "Maracaibo," which, however, is in Venezuela.

500TH MEETING OF THE CAMBRIDGE ENTOMOLOGICAL CLUB

In celebration of the 500th regular meeting of the Cambridge Entomological Club a combined dinner and meeting was held on Tuesday, December 15th, at the Faculty Club of Harvard University. Following an excellent dinner, in which thirty persons participated, the toastmaster of the evening, W. L. W. Field, opened the proceedings by reading from the minutes of the first meeting in 1874. Professor Nathan Banks was the first of the after-dinner speakers, and spoke of the need of specialization and the furtherance of systematic entomology. Vice-President C. W. Collins, who was in charge of the meeting, brought the felicitations of the Bureau of Entomology, and traced the development of economic entomology during the existence of the club. Professor C. T. Brues gave a delightfully humorous talk on some of the peculiar and amusing incidents encountered in connection with his office as editor of "*Psyche*." Mr. C. W. Johnson sketched the course of the club since its inception in 1874 as an offspring of the Boston Society of Natural History to the present; he also bore the congratulations of the parent organization and its thanks for the cooperation of the members of the Cambridge Entomological Club in contributing materially to the establishment of the extensive and representative collection of New England insects in the Boston Museum of Natural History. Professor A. P. Morse reminisced on the earlier days of the club, giving intimate glimpses of meetings at the home of Samuel Scudder.

Following the after-dinner speeches, an interesting motion picture film illustrating the life history of the yellow-fever mosquito was shown.

The scientific paper of the evening was given by Dr. Joseph Bequaert on "Some Problems of Medical Entomology in Guatemala."

During the course of the evening, a rising vote was passed authorizing a message in recognition of the death of A. G. Weeks, during the preceding week. Messages of respect, remembrance, and affection were also drawn up in honor of Mr. Samuel Henshaw and Professor Roland Thaxter.

It was not until 11:00 P. M. that this, one of the most enthusiastic and highly successful meetings of the Cambridge Entomological Club, was brought to adjournment.

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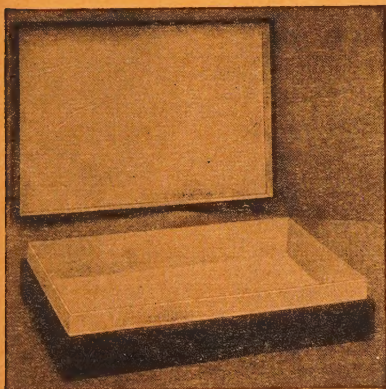
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CAMBRIDGE ENTOMOLOGICAL CLUB

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